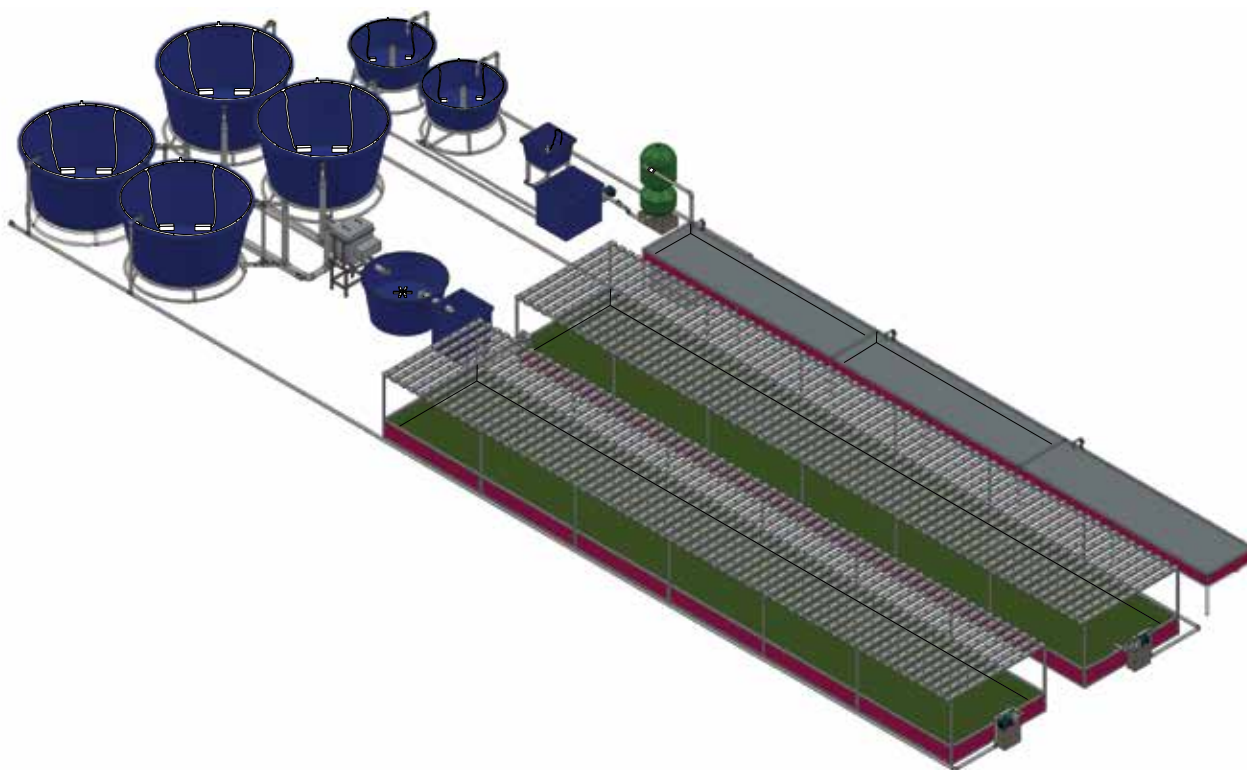




HydroCycle Aquaponic Systems



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Revision date: 09.30.16

112668	AQUAPONIC SYSTEM VI
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*Actual system layout may differ from example shown.

Important Information

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USING THIS MANUAL

The commercial aquaponic system is a large system with many parts. This manual is divided into different sections. Each section shows one procedure or multiple related procedures. For best results, before assembly begins, read through this entire document to better understand the different assembly procedures.

Overall assembly process depends on available space and assistants. Construction of main components such as raft and media beds can occur at any time. **Since these require the most space during assembly, it may be best to store frame components outside of the assembly area and first set tank stands and tanks in place.**

When it is time to assemble raft and media bed frames, separate the different frame components. Review the different sections of this manual to identify raft and media bed frame part numbers. Doing this helps prevent confusion and mistakes during assembly.

Use the recommended layout diagrams on the following pages to get started. If you are constructing a greenhouse or other building to house the aquaponic system, ensure there is a sufficient opening for the 1,200 gallon tanks and stands to pass through.

Here are steps to prepare for assembly and to help get you started:

1. Read through this manual to better understand the different assembly procedures. Review Table of Contents (left column).
2. Determine basic system layout and placement in building.
3. Locate all bed liners and move to a safe location until installation.
4. Set stands and tanks (without stands) in place.
5. Take inventory of all plumbing parts and pvc tubing.
6. Separate and inventory the different media bed and raft bed parts.
7. Begin assembly.



CAUTION: Tanks are heavy when filled. Building floor must be capable of supporting all tanks when filled. Finished concrete is recommended to prevent settling. Take the necessary steps to construct a solid surface before setting tanks. **Once filled, tanks cannot be moved.**

Important Information

READ THIS DOCUMENT BEFORE YOU BEGIN

Thank you for purchasing the 112668 Commercial Aquaponic System. When properly assembled and maintained, this system will provide years of reliable service. These instructions include helpful hints and important information needed to safely assemble and properly maintain the system. Please read and understand these instructions **before** you begin. If you have any questions during the assembly, contact customer service.

SAFETY PRECAUTIONS

- Wear eye protection.
- Wear gloves when handling metal pipes.
- Use a portable GFCI (Ground Fault Circuit Interrupter) when working with power tools and cords.

REQUIRED TOOLS

The following list identifies the main tools needed to assemble the aquaponic system. Additional tools may be needed.

- Tape measure and marker
- Variable speed drill (cordless with extra batteries works best)
- Small hammer and gloves
- Level (4' or longer— recommended) and line level
- Utility knife or scissors
- Tool to cut pvc tubing
- Assorted hand tools common to construction, plumbing, and electrical work
- Drill bit set with assorted bits.
- Hole saw bits: 2-1/4", 2-1/2", 3", and 5"
- Small hand-held grinder with metal cutting bit to cut expanded metal.
- Large adjustable pliers (3"-4" jaw)
- 3/16" & 7/32" hex (Allen) wrench or bits — preferably bits to attach to power drivers. **Used to install 112772 & 115303 screws.**



ASSEMBLY PROCEDURE

Following instructions as presented will help ensure proper assembly of your aquaponic system. Steps outlining assembly are as follows:

1. Verify that all parts are included in the shipment. Notify customer service for questions or concerns. See below.
2. Read and understand these instructions and the information included with the shipment **before** you begin.
3. Gather tools and recruit assistants.
4. Assemble aquaponic system.
5. Read additional information as presented.

UNPACK AND IDENTIFY PARTS

The following steps will ensure that you have all the necessary parts **before** you begin assembly.

1. Unpack contents of shipment and place where you can easily inventory parts. Refer to Bill of Materials/Spec Sheets.
2. Verify that all parts listed on Bill of Materials/ Spec Sheets are present. If anything is missing or you have questions, consult all diagrams and photos for clarification, or contact Customer Service.

NOTE: At this time, you do not need to open the plastic bags containing smaller parts such as fasteners or washers (if equipped).

FLOOR DRAIN: The drum filter included with this system requires a floor drain to accept water during the high pressure rinse cycle.



WARNING: Enlist the services of an experienced electrician when connecting power to the pump and other electrical devices.

All wiring to be completed according to established codes and practices.



DROWNING HAZARD: Never allow children or others within the boundary of the tanks, raft beds, and pump stations at any time.

Always have an assistant present during harvest, tank cleaning, and system maintenance to prevent accidents.

ABOUT THIS MANUAL

This manual describes how to set up your aquaponic system and check for proper operation. Additional information is presented regarding basic system maintenance.

This manual does not however describe how to grow various types of fish and plants. Since the specifics of such an undertaking have filled many books, it is best to determine beforehand exactly how you want to use this system. Water quality, location, growing environment, available resources, personal knowledge and experience among other things all must be considered before populating system with plants and fish.

Consult with your sales representative for additional resources and information to ensure a successful start.

Important Information

A NOTE ABOUT COLOR CODES REGARDING COMPONENTS IN THIS KIT

Many parts are marked with a specific color to help with identification, inventory, and assembly. When possible, separate shipment by color before you begin. In the event that a part is not found, it is possible it is packaged with another color as many parts, especially pvc pipe and fittings, are the same and used in different sections of the aquaponic system. Review color codes presented below and take note of their use throughout this assembly guide. If bags get opened and parts are mixed during assembly, use actual part ID number and diagrams presented throughout this guide for additional guidance.

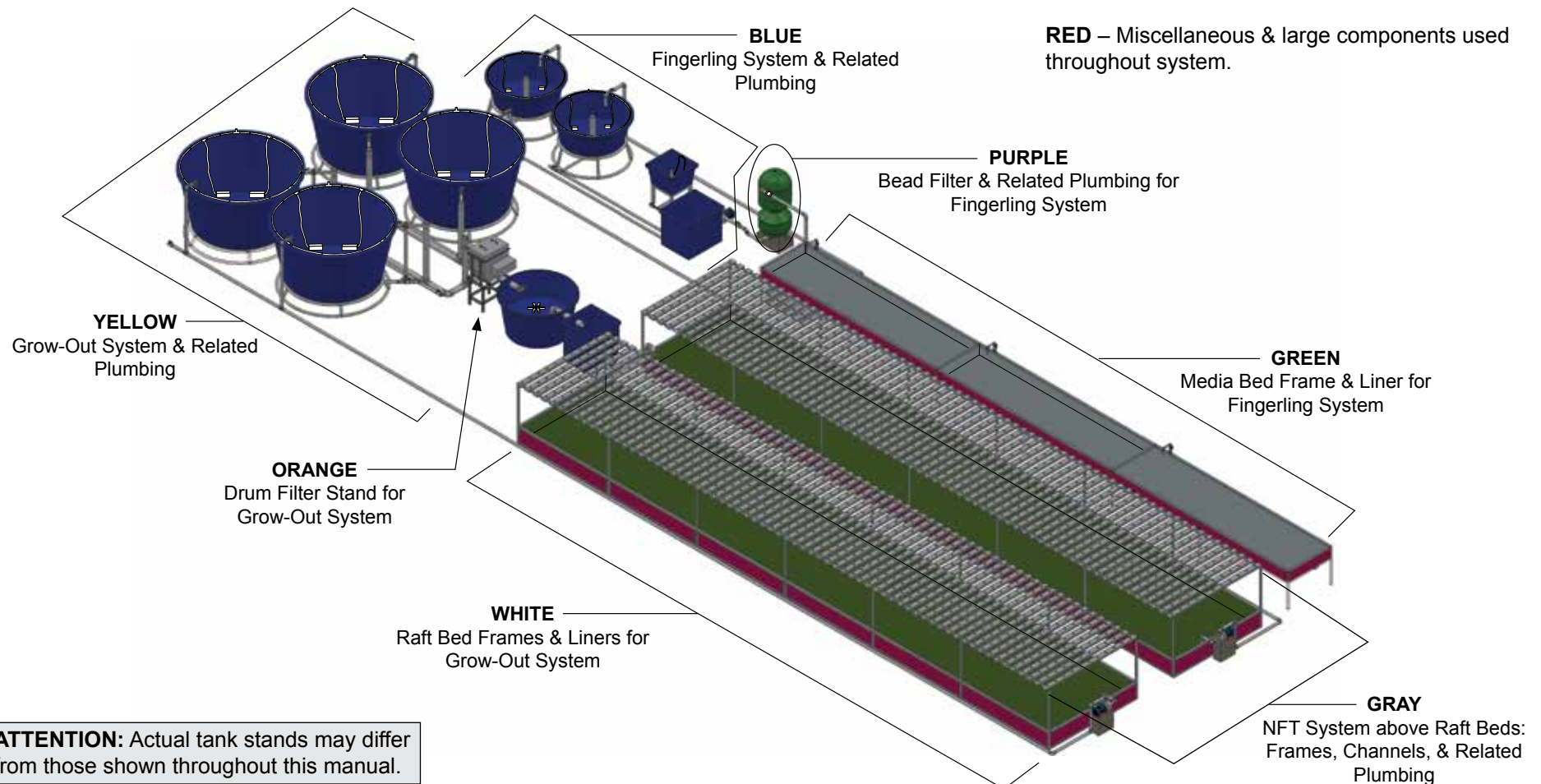
COLOR CODE

ATTENTION: When noted, a color code is found in upper-right corner of a page.

Colors not shown in diagram:

BLACK – Aeration components for Fingerling and Grow-Out Systems.

RED – Miscellaneous & large components used throughout system.



General Information & Maintenance

SITE

The linear layout throughout this guide shows the aquaculture system running parallel with the hydroponic system. This layout allows for even flow of water throughout both systems. Any layout that varies from this suggested model may require gate valve adjustments and additional purchase of pvc pipe and fittings.

Routine maintenance of the aquaculture system requires flushing valves and lines. If possible, position drain line outlets near (or pipe directly into) a floor drain. Clean solids off floor to prevent pathogen growth.

If entire system is located in a greenhouse, installing 100% shade material above the aquaculture section is strongly recommended. Shade helps prevent algae issues in tanks (fish tanks, biofilter tank, and sump tank).

FLOW RATES IN TANKS

Flow rates are measured by timing how long it takes to fill a known volume of water: (e.g., 5 gallon bucket = 5.63 gallons). Adjust rates using the ball valves at each tank. See the "Adjust Flow Rate" section near the back of this manual.

DRUM FILTER

Drum filter requires routine maintenance as described in documentation included with filter. Proper record keeping of this maintenance is strongly recommended to ensure uninterrupted operation. Read and understand the filter documentation before system startup and to troubleshoot system after startup.

IMPORTANT: WINDOW KITS FOR FISH TANKS

If window kits were purchased for the 250 or 1,200 gallon fish tanks, install those before preparing tanks and setting them in place on tank stands.

BEAD FILTER

Regular maintenance of the bead filter ensures efficient and dependable operation. Review and follow these procedures to maintain the bead filter:

- During setup, plumb the discharge end of the three-way valve directly to a drain, or elsewhere for offline processing of solids.
- Backwash bead filter at least every other day. This process requires draining all water from the filter to eliminate solid waste that collects.
- For a more robust backwash, a pump can be plumbed to the bead filter discharge to extract solids.
- Maximum operating pressure is 10 psi. Use the inline ball valve and pressure gage preceding the bead filter to adjust and manage pressure.
- Read, understand, and follow all directions found in the documentation included with bead filter.



1,200 GALLON AND 250 GALLON TANK STAND DESIGNS

This system includes redesigned tank stands for the 1,200 and 250 gallon tanks that are stronger and easier to level. These new designs require minor assembly before setting tanks and installing plumbing. Size and weight of each stand for a 1,200 gallon tank require the assembly of these stands in the area where the system will operate. **Stands are not easily moved once assembled.**

Additionally, many diagrams throughout this assembly guide show the original tank stands for both the 1,200 and 250 gallon tanks. Stands function the same regardless of the design difference shown in some diagrams and photos. **When setting tank stands, orient stand so support legs allow easy installation and routing of plumbing as shown in diagrams. and photos.**

FINGERLING SYSTEM: RAPID DRAIN-TO-WASTE VALVES

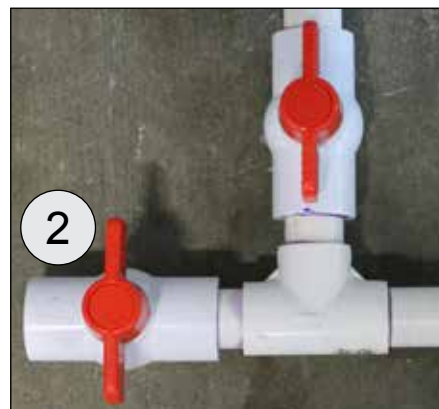
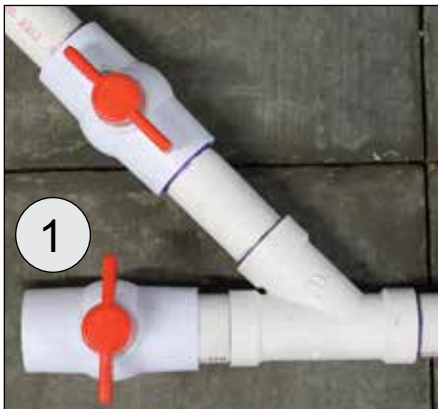
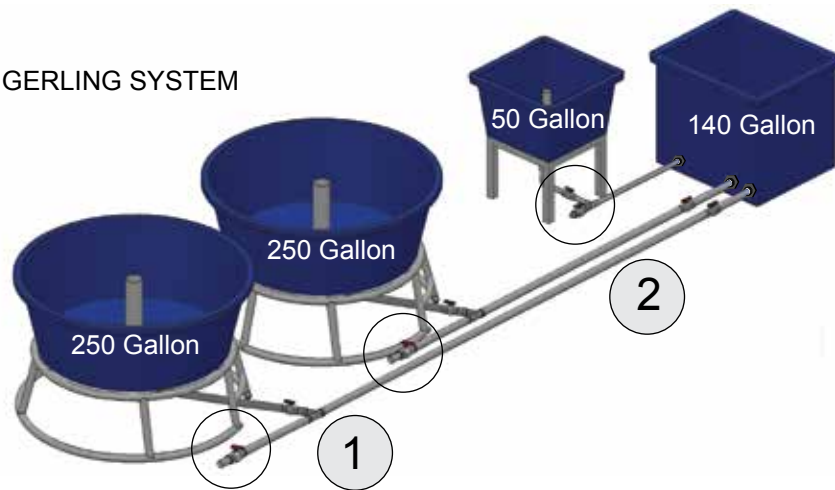
A ball valve at the end of each drainage line is designed to rapidly drain water from the fish tanks. **To prevent biofouling, flush these valves once a day.** (See 1 & 2 below.)

GROW-OUT SYSTEM: RAPID DRAIN-TO-WASTE

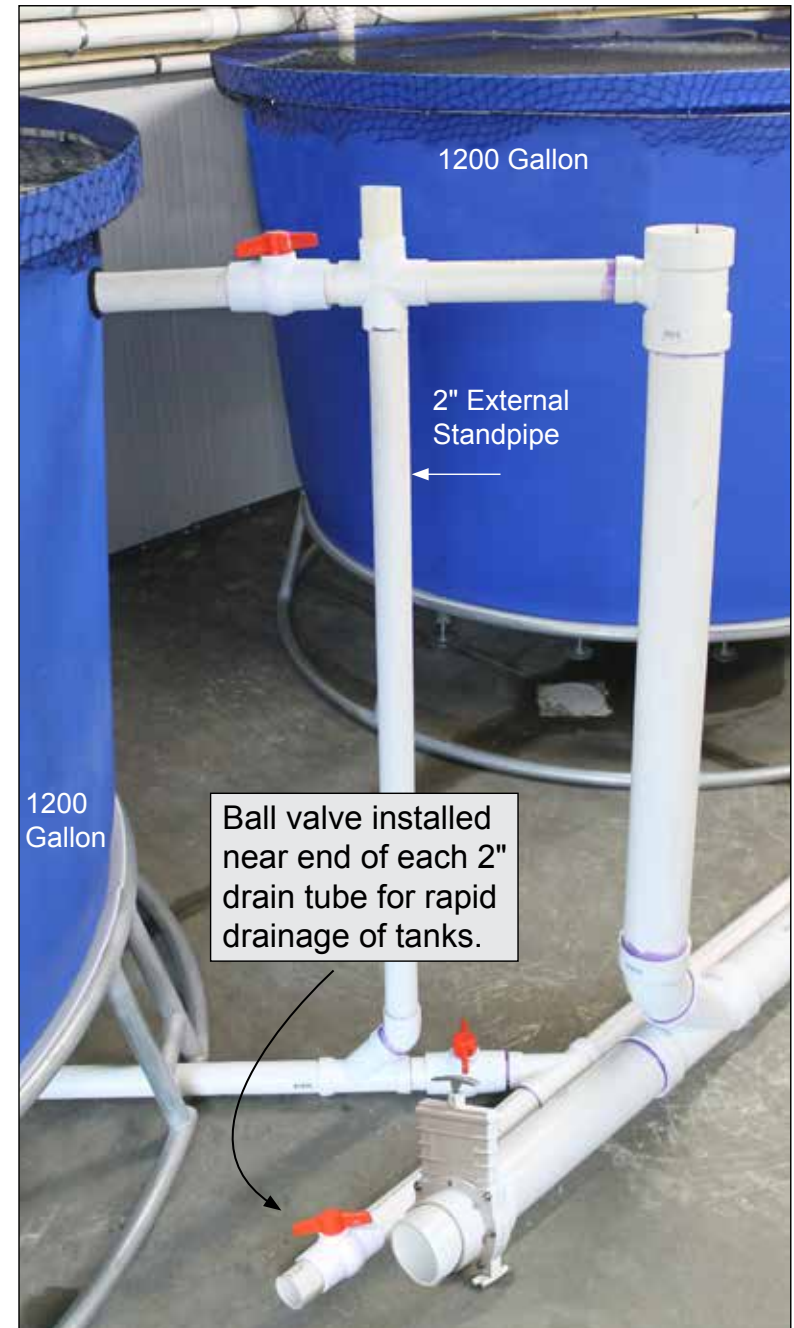
The 2" plumbing at the bottom of the external standpipes in the grow-out system are designed for rapid discharge of tank water. **To prevent accumulation of heterotrophic bacteria (biofouling) in pipes, open and close these valves once a day when in production.** (See diagram at right.)

NOTE: The only way to empty a grow-out tank is to open these 2" valves.

FINGERLING SYSTEM



GROW-OUT SYSTEM

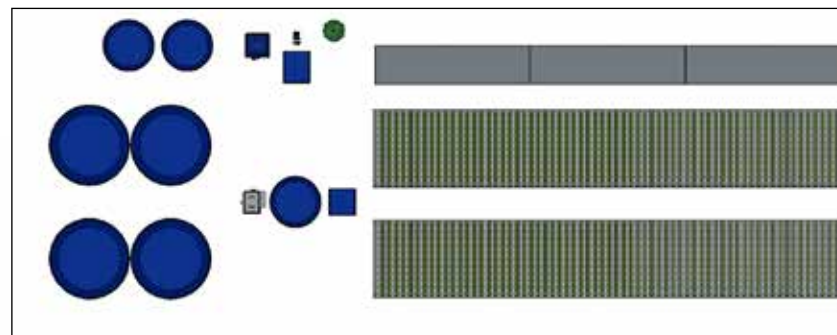


Aquaponic System Site Plan—Sample

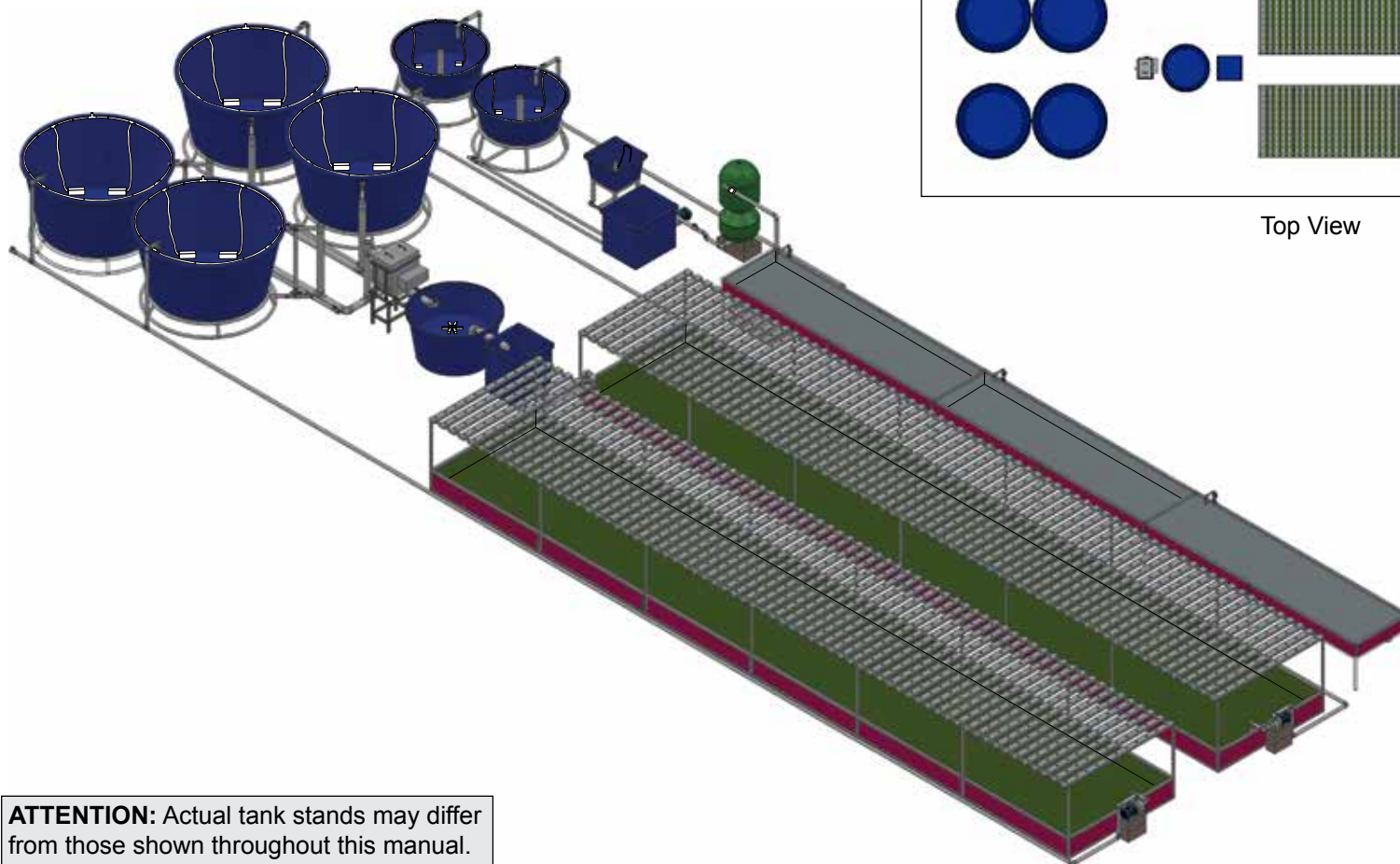
1

Diagram below shows the basic layout of the 112668 aquaponic system. Use this diagram when planning where to position your system. Review all diagrams and photos in this guide before you begin.

ATTENTION: Diagram below shows recommended system layout. Increasing distance between tanks or between tanks and beds may require the purchase of additional pvc tubing, or fittings, or both.



Top View



ATTENTION: Actual tank stands may differ from those shown throughout this manual.

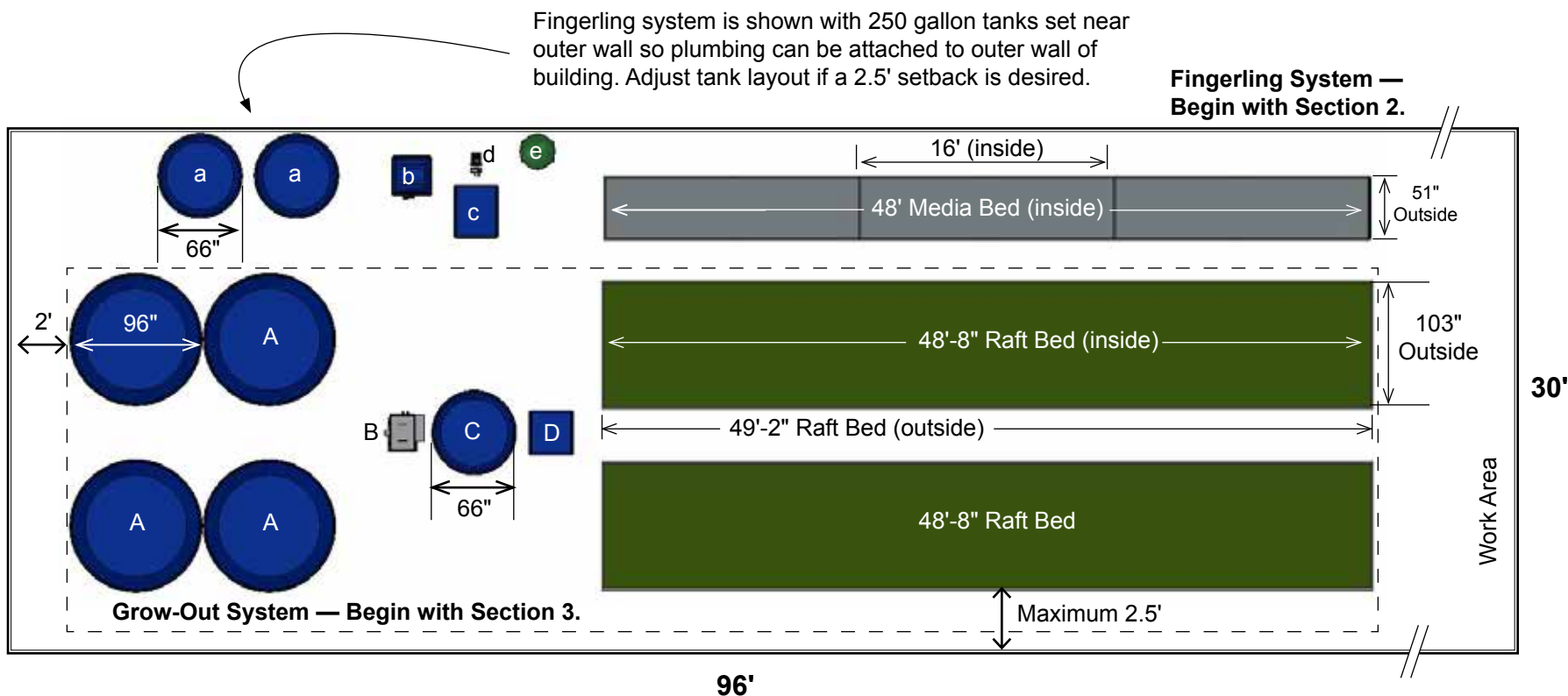
Recommended Setbacks for 30' x 96' Building

1

Diagram below shows recommended setbacks from building walls. Needs specific to your operation may require a different layout with alternative setbacks. Quantity of pipe and fittings included with this system is based on recommendations found throughout this guide. **Altering dimensions shown may require the purchase of additional pvc and related fittings.**

ID#	FINGERLING SYSTEM COMPONENTS
a	250 GALLON TANK (AQ103); STANDS: See 1a to assemble.
b	50 GALLON TANK (AQ104); STAND (AQ105)
c	140 GALLON TANK (AQ102) – SQUARE
d	SYSTEM PUMP (111148)
e	BUBBLE WASH BEAD FILTER (AQ110)

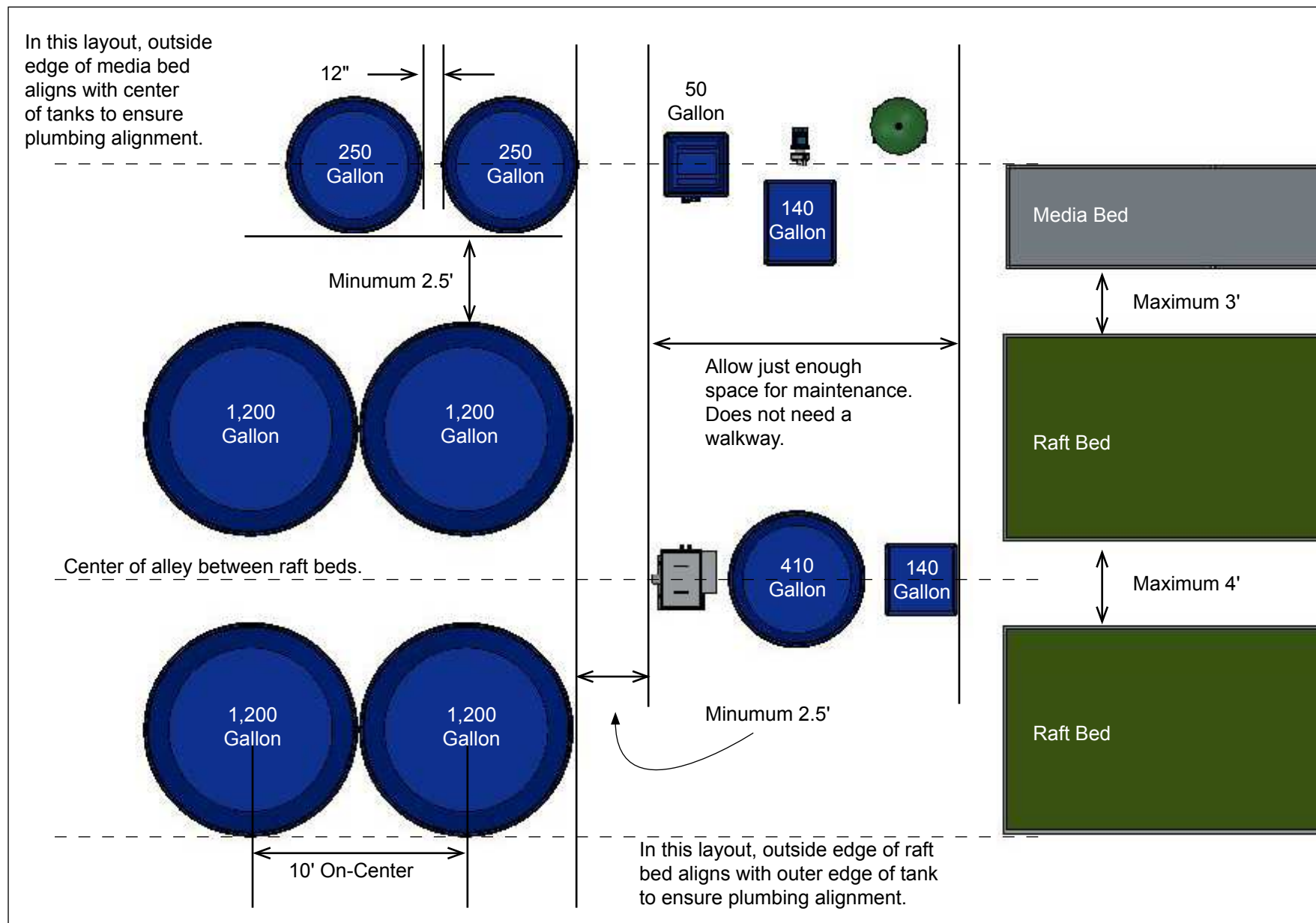
ID#	GROW-OUT SYSTEM COMPONENTS
A	1,200 GALLON TANK (AQ100); STANDS: See 1b to assemble.
B	MICRO-SCREEN DRUM FILTER (113458) & STAND
C	410 GALLON BIOFILTRATION TANK (AQ101)
D	140 GALLON SUMP TANK (AQ102)



Recommended System Layout for 30' x 96' Building

1

Diagram below shows recommended distances between system components. Needs specific to your operation may require a different layout. Quantity of pipe and fittings included with this system is based on recommendations found throughout this guide. Altering dimensions shown may require the purchase of additional pvc and related fittings. Slight adjustments can be made to accommodate personal preferences.



Assemble Stands for 250 & 1,200 Gallon Tanks

1a

ASSEMBLE TANK STANDS — General Information

This commercial aquaponic system includes two (2) separate systems: the grow-out system and fingerling system. (See setback and layout diagrams on previous pages.) Each system functions independently and can be assembled as such. To best judge positions of media and raft beds and to ensure economic use of available space and pvc pipe, assemble and set all stands in place to get started.

Section 1a: Review diagrams on previous pages, assemble and set main tank stands according to layout dimensions shown. Review overall layout and position stands so system plumbing can be connected as shown in diagrams.

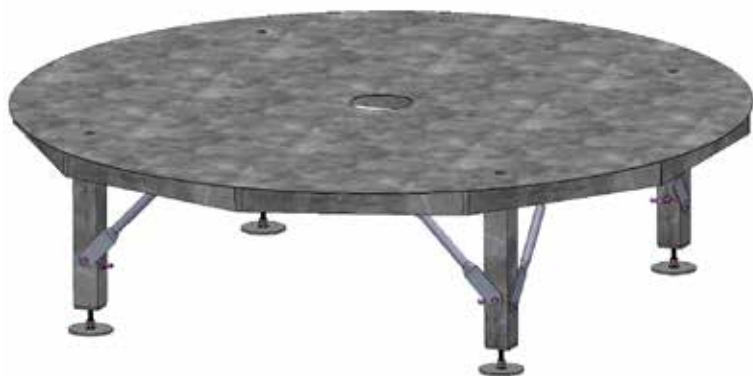
Turn stands so support legs do not interfere with plumbing installation.

Gather the components shown at the right and stage for assembly. Assistants are required to move and level the assembled stand. **Do not move alone!**

ATTENTION: The stands for the 250 and 1,200 gallon tanks are heavy when assembled. These should be assembled at or near the spot where they will be in use to minimize moving and to facilitate leveling of each stand. Once assembled and leveled, **they cannot be moved without repeating the leveling steps.**

Leg support assemblies require a solid surface. If stands are not positioned on concrete as recommended, take additional steps to construct a solid base on which to mount each tank stand support. Take the necessary steps to firmly pack the soil or gravel and then bury concrete blocks, pavers, or solid wood blocks *level with finished grade* for each support. **Do not set on soil, sand, or gravel. Do not set tank stands on raised blocks or platforms.**

IMPORTANT: To ensure proper water levels throughout the system during operation, **set tank stands on the same finished grade as the float beds.** Review layout diagrams for additional details.



Stand for 250 Gallon Tank



Stand for 1,200 Gallon Tank

ATTENTION: Stands require a solid base such as reinforced concrete or concrete pavers capable of supporting full tanks for adequate support and to prevent settling. Take the necessary steps to construct a solid surface before setting tanks. **Review notes above for additional comments.**

1a

ASSEMBLY TANK STANDS: 250 GALLON TANKS

COLOR CODE: BLUE & RED

Stands for the 250 gallon tanks of the fingerling system consist of a single top plate and frame, four (4) leg supports, and eight (8) struts. Complete these steps to assemble the two (2) stands for the 250 gallon tanks.

1. Assemble four (4) leg supports by threading an FALB04B locking nut onto the 113030S03 adjustable footer and thread that assembly into leg tube.
IMPORTANT: Install adjustable footer at end of leg support tube that includes the strut mounting holes. See diagram.
2. Set distance from top of adjustable foot to leg assembly at approximately 1" or so.
3. Next, take one AQ156 top plate and frame section and attach leg assemblies as shown using the 115303 flat head bolts. Block top in place for easier assembly.
4. Tighten using a 7/32" Allen wrench. Verify that bolt holes for struts are oriented so struts align with mounting holes. See diagrams on next page.

ATTENTION: Mounting holes on legs are in different positions. If legs are installed incorrectly, mounting holes in struts will not align with mounting holes in frame top. Use a strut to match hole locations during leg installation.

Use these parts to construct stands for the 250 gallon tanks:

- AQ156 One-Piece Top Plate & Frame
- AQ145 Support Leg
- AQ144 Strut
- 113030S03 Adjustable Footer
- 115303 (3/8"-16 X 3"L FLAT HEAD BOLT ZINC)
- FALB04B (NUT 3/8-16 ZINC EACH)
- FAG338B (HEX CAP 5/16 X 3" ZINC – EACH)
- FAME07B (BULK FLT WSH 5/16" ZINC – EACH)
- FALB02B (NUT BULK 5/16-18 ZINC – EACH)

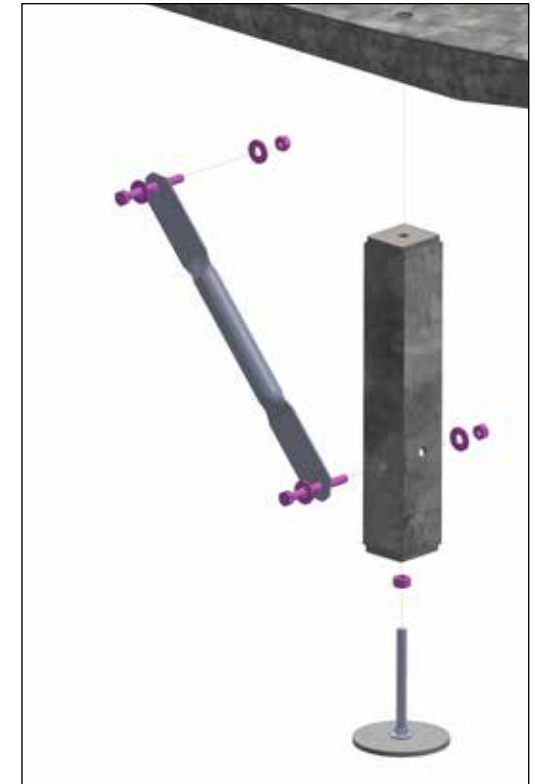


1a

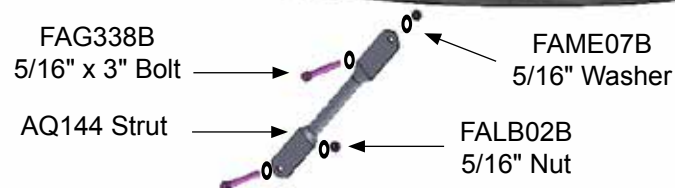
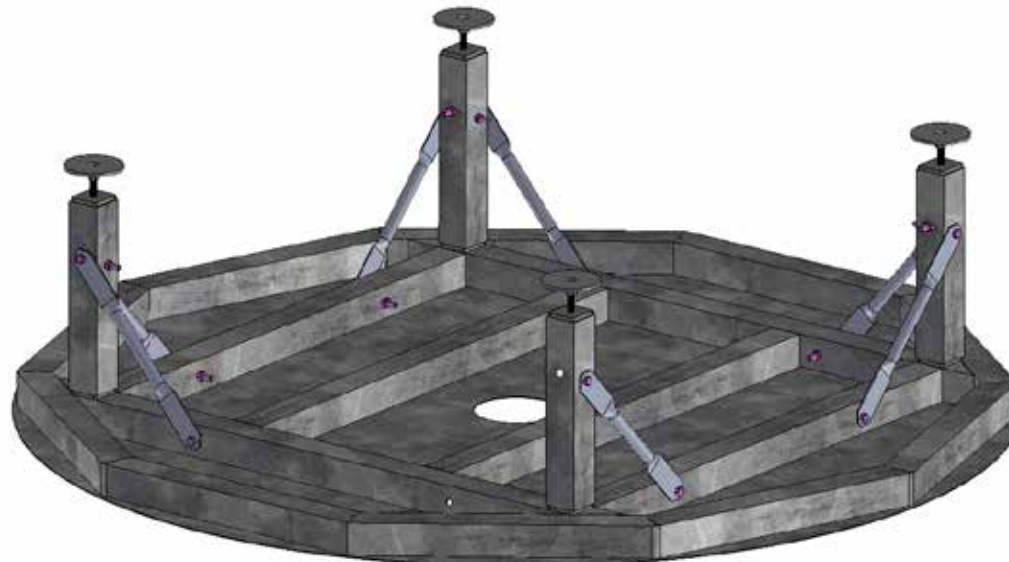
ASSEMBLY TANK STANDS: 250 GALLON TANKS — continued

5. Attach two (2) struts to each leg and secure to underside of top plate. See diagram for fastener part numbers. *Add two (2) flat washers to each bolt – one against bolt head and one against the nut.*
- NOTE:** Struts are all the same length. If holes do not align with frame holes, loosen leg support, turn leg one-quarter turn, and retighten. Check alignment.
6. With assistance, set stand in place using layout diagrams presented earlier as guides. Remember to orient stand so plumbing does not contact stand support legs.
7. Using a level (minimal 4'), adjust feet as needed to level stand. Once set, tighten locking nut on each adjustable foot.
8. Repeat to assemble and level remaining 250 gallon tank frame.
9. Continue by assembling stands for the 1,200 gallon tanks.

COLOR CODE: BLUE & RED



Set stand in place and level. Tight locking nuts.



1b

ASSEMBLY TANK STANDS: 1,200 GALLON TANKS

Assemble all tank stands for 1,200 gallon tanks using parts shown at the right and set stands in position. Complete these steps to assemble a single stand:

1. Assemble nine (9) leg supports by threading an FALB04B locking nut onto the 113030S03 adjustable footer and thread that assembly into leg tube.

IMPORTANT: Install adjustable footer at end of leg support tube that includes the strut mounting holes. See diagrams.

2. Set distance from top of adjustable foot to leg assembly at approximately 1" or so.
3. Next, take one 1/3 stand section (AQ152 top plate and frame) and attach leg assemblies as shown using the 115303 flat head bolts. See lower right
4. Tighten using a 7/32" Allen wrench. Verify that bolt hole for strut attachment is positioned as shown to allow for strut installation.

ATTENTION: Mounting holes on legs are in different positions. If legs are installed incorrectly, mounting holes in struts will not align with mounting holes in frame top. Use a strut to match hole locations during leg installation.

COLOR CODE: YELLOW & RED

Use these parts to construct stands for the 1,200 gallon tanks:

- AQ152 Top Plate & Frame (1/3)
- AQ145 Support Leg
- AQ144 Strut
- 113030S03 Adjustable Footer
- 115303 (3/8"-16 X 3"L FLAT HEAD BOLT ZINC)
- FALB04B (NUT 3/8-16 ZINC EACH)
- FAME08B (BULK FLT WSH 3/8" ZINC – EACH)
- FAG369B (HEX CAP 3/8 X 5" ZINC)
- FAG338B (HEX CAP 5/16 X 3" ZINC – EACH)
- FAME07B (BULK FLT WSH 5/16" ZINC – EACH)
- FALB02B (NUT BULK 5/16-18 ZINC – EACH)



1b

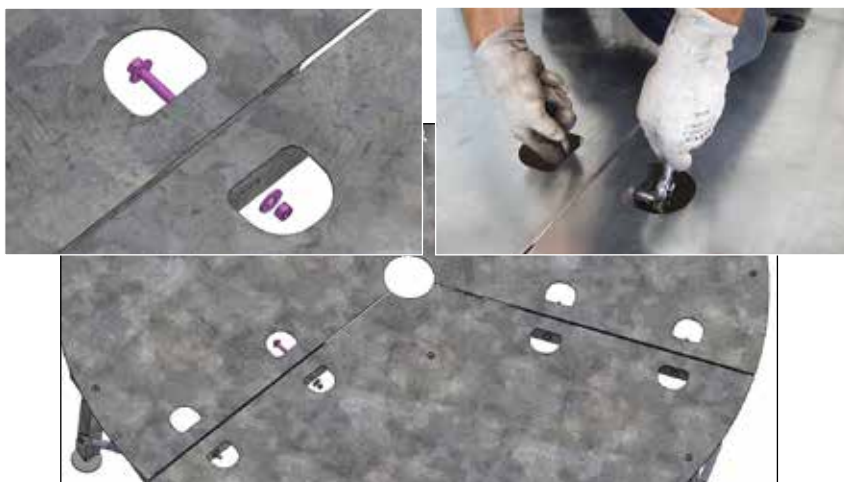
ASSEMBLY TANK STANDS: 1,200 GALLON TANKS — continued

COLOR CODE: YELLOW & RED

- Attach one strut to each leg and secure to underside of top plate. See diagram for fastener part numbers.

NOTE: Struts are all the same length. If holes do not align with frame holes, loosen leg support, turn leg one-quarter turn, and retighten. Check alignment.

- Repeat the steps to assemble remaining two (2) sections of the first 1,200 gallon tank stand.
- With assistance, set stand sections in place on concrete slab or supports and carefully slide together.
- Align holes and install fasteners. See diagram below.



NOTE: Add two (2) flat washers to each bolt – one against bolt head and one against the nut.

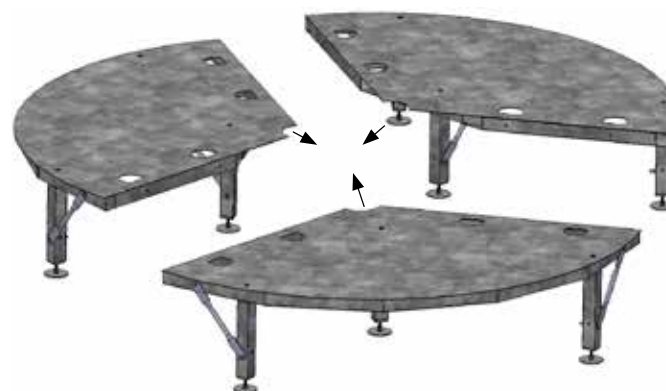
- Verify that tops of adjacent sections are flush and tighten bolts.
- Set stand in place according to layout diagrams and level. Remember to orient each stand to allow for installation of all plumbing. Review diagrams.
- Repeat procedure to assemble and set all remaining stands for the 1,200 gallon tanks.
- Continue with the next procedure.

FAG338B
5/16" x 3" Bolt

AQ144
Strut

NOTE: Add two (2) flat washers to each bolt – one against bolt head and one against the nut.

FALB02B 5/16" Nut and FAME07B
5/16" Flat Washer



Drum Filter Stand Assembly

1c

ASSEMBLE DRUM FILTER STAND

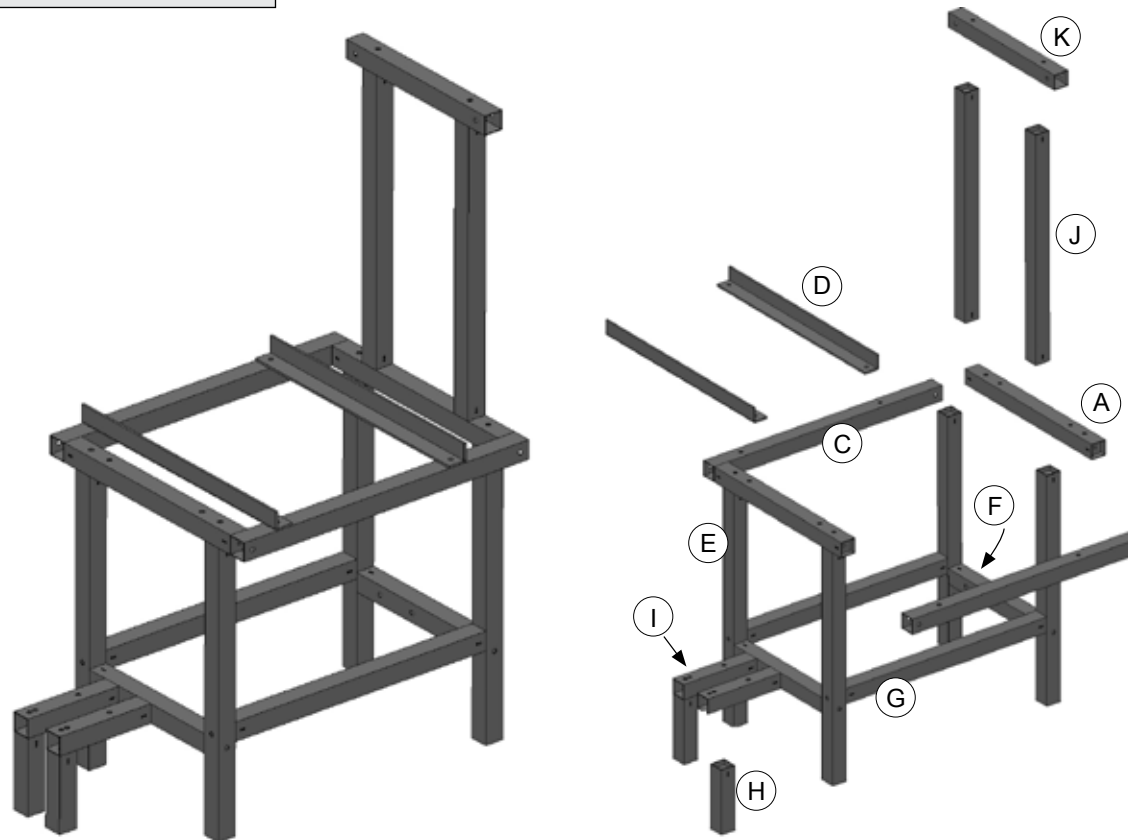
Use diagram and table below to assemble drum filter stand.
Secure all connections using:

- FAG336B (5/16" x 2-1/2") bolts
- FAME07B (5/16") flat washers (1 per bolt)
- FALB02B (5/16") nut (through connections only)
- FAMA37B (5/16") lock washers (use with nuts only)

ATTENTION: Fasteners are included to secure electrical panel and high pressure pump to frame tubes as described in Section 3.

COLOR CODE: ORANGE

Part #	Description	ID #
AQ005A	Upper Frame Support — Inner Tube (Short) — 18"	A
AQ005C	Upper Frame Support — Outer Tube (Long) — 25"	C
AQ005D	Drum Filter Support — Right Angle — 21"	D
AQ005E	Frame Support — Leg — 22-1/2"	E
AQ005F	Lower Frame Support — Inner Tube (Short) — 12-1/2"	F
AQ005G	Lower Frame Support — Outer Tube (Long) — 22-1/2"	G
AQ005H	Motor Mount — Leg — 6-1/2"	H
AQ005I	Motor Mount — Horizontal Tube — 8"	I
AQ005J	Electrical Panel — Vertical Support — 22-1/2"	J
AQ005K	Electrical Panel — Upper Horizontal Tube — 15"	K



Fingerling System Tank Templates & Install Fittings

2

PREPARE TANKS FOR BULKHEAD FITTINGS

Locate and isolate these tanks for fingerling system: two (2) round 250 gallon tanks with stands, one (1) 50 gallon square tank (conical bottom) with stand, and one (1) rectangular 140 gallon tank. Drill holes for bulkhead fittings in locations shown.

Complete these steps to prepare tanks.

1. Using tank templates, drill holes in tanks in locations shown.
2. After drilling each hole, take a piece of light sandpaper and smooth edges to remove shavings.
3. Vacuum all tank shavings from tank after drilling holes.

COLOR CODE: BLUE

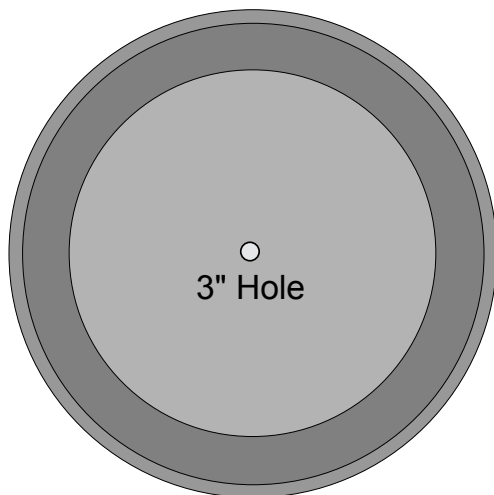
Required Tools:

- 2-1/4" and 3" hole saw bits
- Battery-powered drill
- Tape measure and marker
- Sandpaper to smooth hole edges

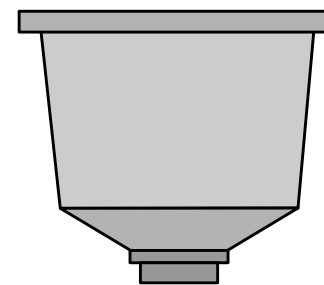
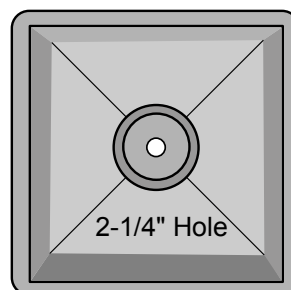


Tanks for Fingerling System

Top View — 250 Gallon Tank Template



Top View — 50 Gallon Tank Template



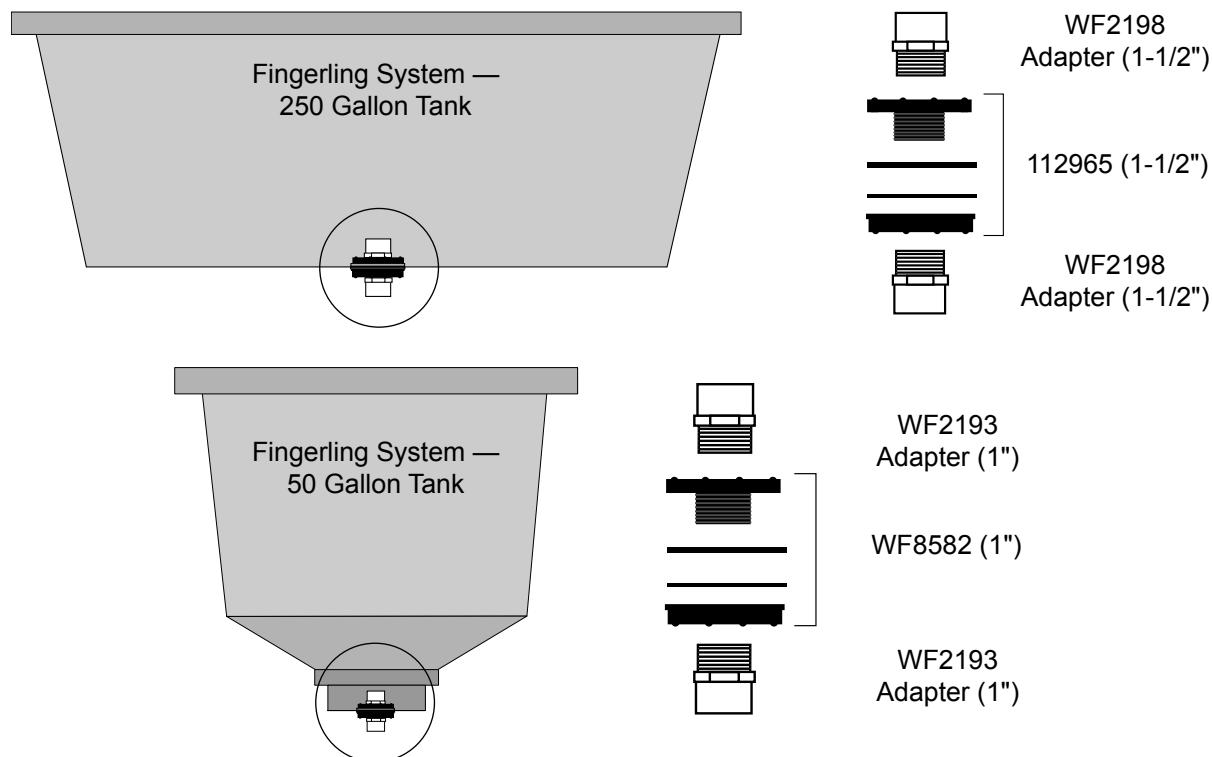
ATTENTION: Drill a 3" hole in bottom of each 250 gallon tank; drill a 2-1/4" hole in bottom of 50 gallon tank.

2

INSTALL BULKHEAD FITTINGS

4. Review diagrams below and install bulkhead fittings.

NOTE: Tanks have a specific bulkhead assembly. Confirm that correct fittings are used when installing these fittings. See diagrams. *In most instances, one or both adapters can be installed before bulkhead is attached to tank. Verify that bulkhead locknut fits over adapter before final assembly.*



Bulkhead fitting notes:

- Always install thick, rubber washer **inside tank**.
- Coat adapter threads with thread sealant (113387) before installation. Tighten until snug.
- If bulkhead fitting includes a thin, hard plastic washer, install that against locknut outside tank.
- Tighten all fittings until snug. **Do not overtighten!**

COLOR CODE: BLUE & RED

Photos show a sample bulkhead assembly before it is slid into drain hole of a tank.



NOTE: Some bulkhead fittings include only a thick, rubber washer. Threads on fittings are reversed.

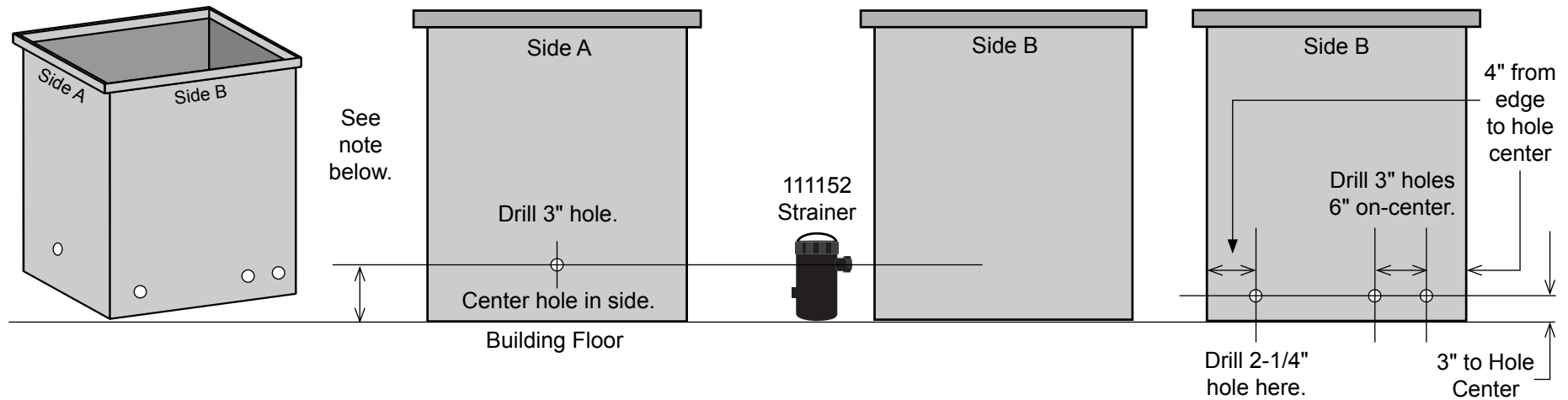
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DRILL TANKS FOR BULKHEAD FITTINGS

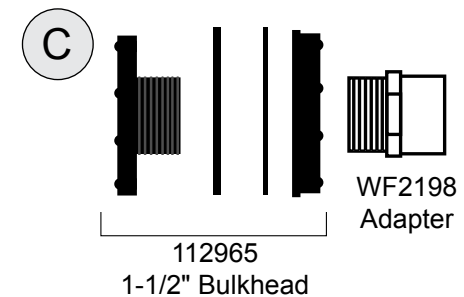
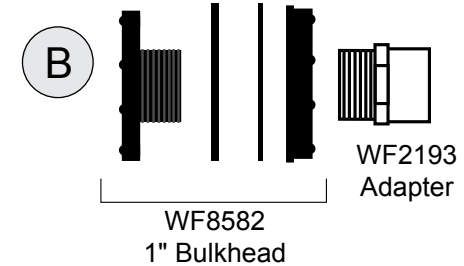
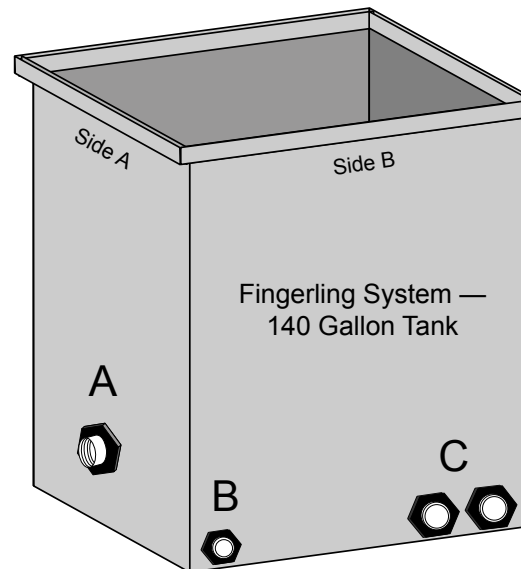
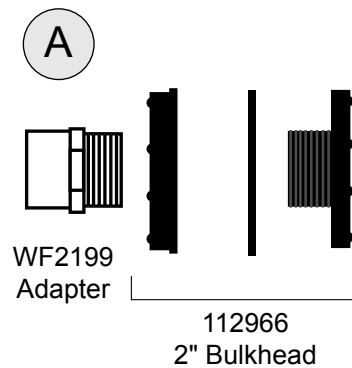
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ATTENTION: Set 111152 strainer next to Side A to gauge hole position, mark tank, and drill 3" hole. For Side B, drill one (1) 2-1/4" hole in lower-left corner. and drill two (2) 3" holes side-by-side in lower-right corner.

Side View — 140 Gallon Tank Template — Drill Holes for Fittings



Side View — 140 Gallon Tank — Install Fittings



ATTENTION: Install all adapter fittings outside the tank. Position thick, rubber washer inside tank. Apply 113387 thread sealant when installing adapters.

Fingerling System: Install Drain Plumbing

2a

ASSEMBLE & INSTALL DRAIN PLUMBING – FINGERLING SYSTEM

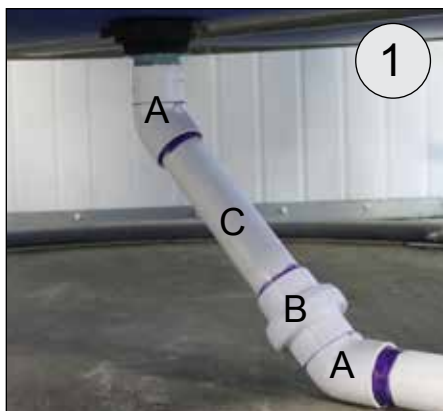
Use photos and information below to assemble and install tank plumbing.

Using PVC Primer (113387) and PVC Glue (WF6990)

Before assembly, coat all slip and pipe connections with pvc primer and pvc glue according to instructions on primer and cement containers.

IMPORTANT: To save time and materials, **dry fit all assemblies and check fit before final assembly!**

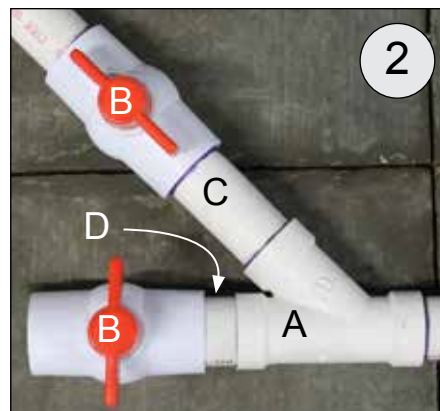
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1-1/2" drain assembly for 250 gallon tank:

A: 112366 45° Elbow
B: 112285 1-1/2" Union
C: Section of 1-1/2" pvc pipe (length as needed to reach floor when assembled)

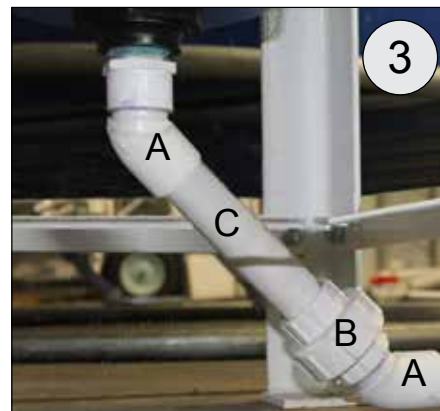
Build two (2) drain assemblies as shown—one for each 250 gallon tank for fingerling system.



1-1/2" Y-fitting assembly for 250 gallon tank drain:

A: 112365 1-1/2" Wye Tee Fitting
B: WF3511 1-1/2" Ball Valve
C: 6" section of 1-1/2" pvc pipe
D: 3" section of 1-1/2" pvc pipe

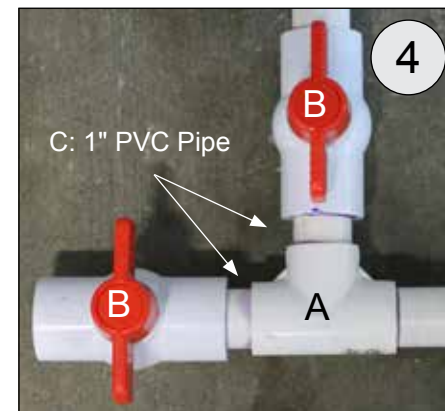
Build two (2) Y-fitting drain assemblies as shown—one for each 250 gallon tank for fingerling system.



1" drain assembly for 50 gallon tank:

A: 111045 45° Elbow
B: WF3420 1" Union
C: Section of 1" pvc pipe (length as needed to reach floor when assembled)

Build one (1) drain assemblies as shown for the 50 gallon tank for fingerling system.



1" T-fitting assembly for 50 gallon tank drain:

A: WF1380 1" Tee Fitting
B: WF3316 1" Ball Valve
C: 4" section of 1" pvc pipe

Build one (1) drain assembly as shown for the 50 gallon tank for fingerling system.

2a

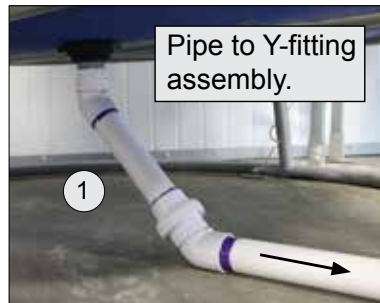
ASSEMBLE & INSTALL DRAIN PLUMBING – continued

After assembling the different drain fittings (previous page), complete steps below to connect drain assemblies using pvc pipes.

1. Verify that all tanks for fingerling system are set in place. Set 250 gallon tank stands to install plumbing as shown.

ATTENTION: Preferred setting is against wall so supply line can attach to customer-supplied stringer board as shown in photo. If tanks are not against a wall, supply line can run on floor with a riser pipe to top of each tank. See diagram on cover of this manual.

2. Connect tank drain assemblies (#1 previous page) to underside of each 250 gallon tank.



Pipe to Y-fitting assembly.

Arrow shows flow direction out to 140 gallon tank.

Align two main 1-1/2" drain pipes with inlet bulkhead fittings on 140 gallon tank. See diagram above.

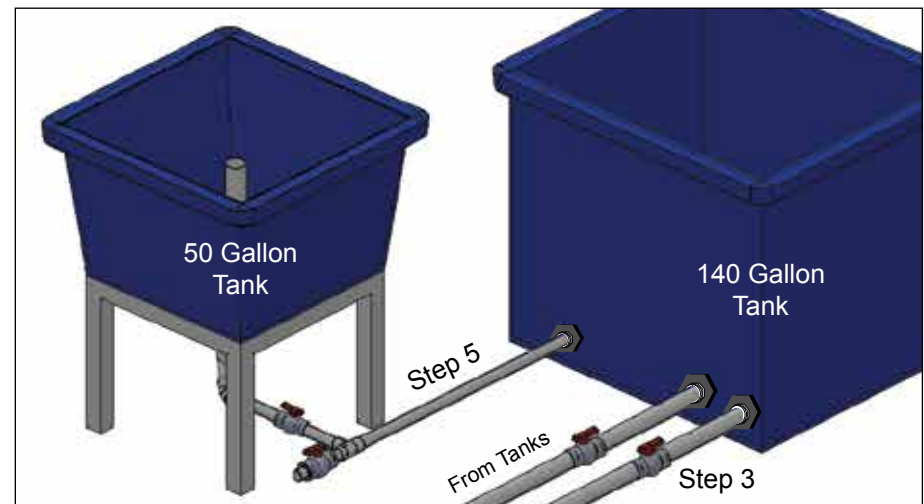
Connect drain lines from 250 gallon tanks to the main drain pipes.

3. Layout remaining pvc drain pipe and Y-fitting assemblies (#2 previous page) to assemble drain pipes leading from 250 gallon tanks to 140 gallon tanks. **Dry fit pipes and fittings first!**

ATTENTION: Review diagrams and photos. Install a ball valve in each 1-1/2" drain pipe before connecting pipe to bulkhead and adapter fitting attached to 140 gallon square tank. If needed, use WF1982 (1-1/2") couplers to connect pipe runs longer than 10'.

4. After confirming pipe lengths, add pvc primer and glue to connect pipe and Y-fitting assemblies. *Remember to install ball valves (WF3511) as shown in photo and diagrams.*
5. Finally, connect 50 gallon tank drain (#3 previous page) to 140 gallon tank bulkhead fitting using 1" pvc pipe and T-fitting assembly (#4 previous page). Confirm tanks are in desired positions.
6. Continue by attaching bead filter to 140 gallon tank.

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Fingerling System: Attach Bead Filter & Pump Assembly

2b

ATTACH BEAD FILTER AND PUMP ASSEMBLY

Use photo at right to attach bead filter to 2" outlet of 140 gallon tank.

1. First, using customer-supplied materials, construct a stand for bead filter. (Stand is not required; however, plumbing alignment and installation is easier if stand is used.) Continue with next step if stand is not used and modify steps as needed.
2. Carefully unpack bead filter and read instructions included with filter. Set filter on stand (if used) and assemble as instructed in documentation included with bead filter.
3. Review list of parts included to connect filter to 140 gallon tank and dry fit as needed to connect pump, strainer, and related pvc fittings.

NOTE: Connect slip-to-slip fittings as needed using short pieces of 2" pvc pipe.

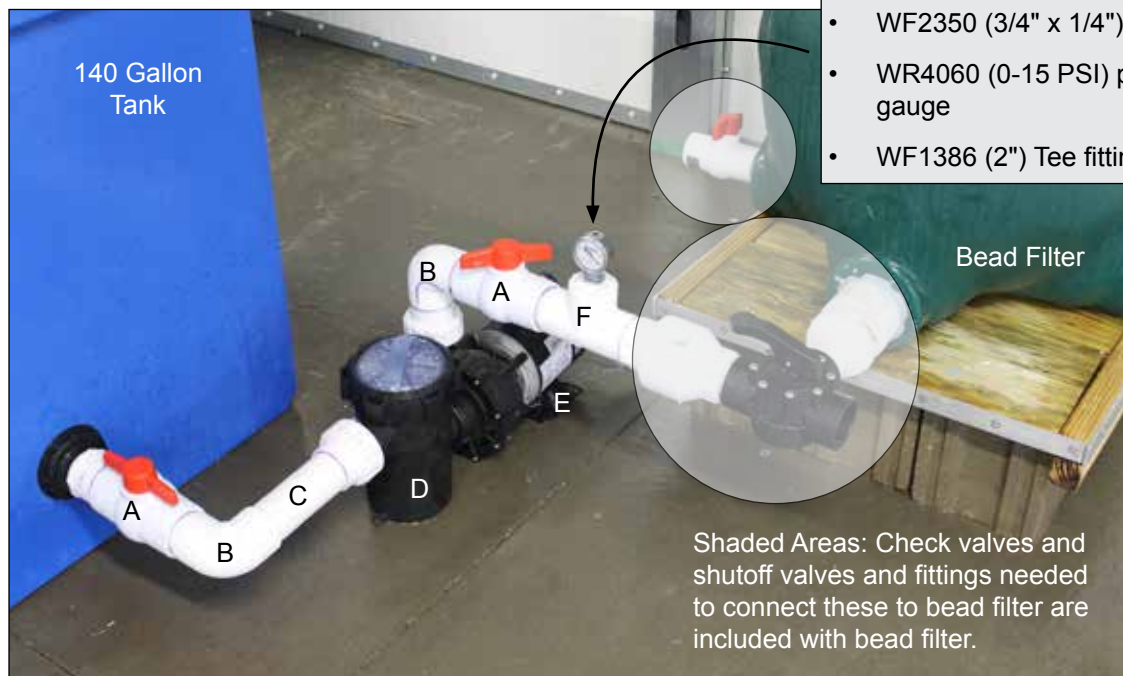
4. Continue with the assembly of grow-out system.

Parts included to connect bead filter to 140 gallon tank:

- WF3516 (2") ball valve (A)
- WF1576 (2") 90° elbow (B)
- 2" PVC pipe (C)
- 111152 Primer/Strainer (D)
- 111148 Dolphin Pump (E)

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- WR1095 Thread Sealing Tape– **For best results, use for all metal-to-plastic fitting connections.**



ATTENTION: Parts attached to bead filter in photo are included with filter. Assemble as shown and continue with pump installation.

Grow-Out System Tank Templates & Install Fittings

3

PREPARE TANKS FOR BULKHEAD FITTINGS

Locate and isolate these tanks for grow-out system: four (4) round 1,200 gallon tanks with stands, one (1) 410 gallon round tank, and one (1) rectangular 140 gallon tank.

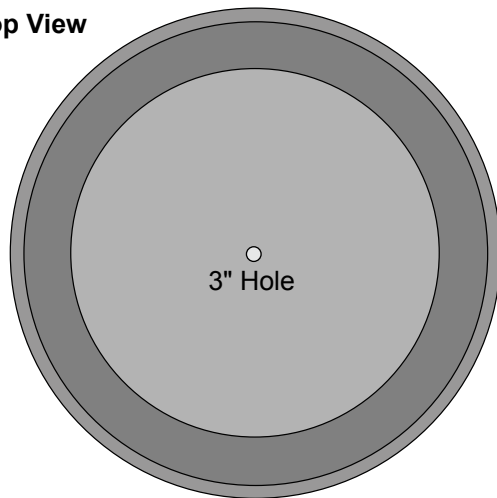
Required tools and materials:

- 3" & 5" hole saw bit & battery-powered drill
- Tape measure and marker and sandpaper to smooth hole edges

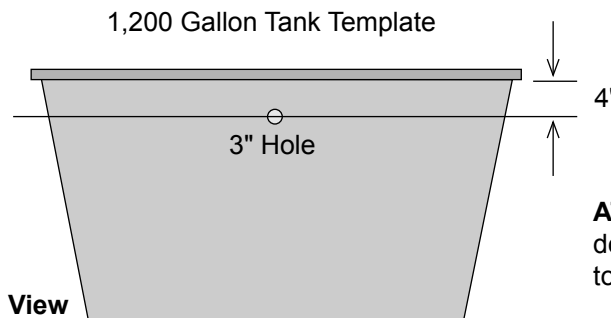
Complete these steps to prepare tanks.

1. Using tank templates below, drill holes in 1,200 gallon tanks in locations shown.
2. After drilling each hole, take a piece of light sandpaper and smooth edges to remove shavings.
3. Vacuum all tank shavings from tank after drilling holes.

Top View



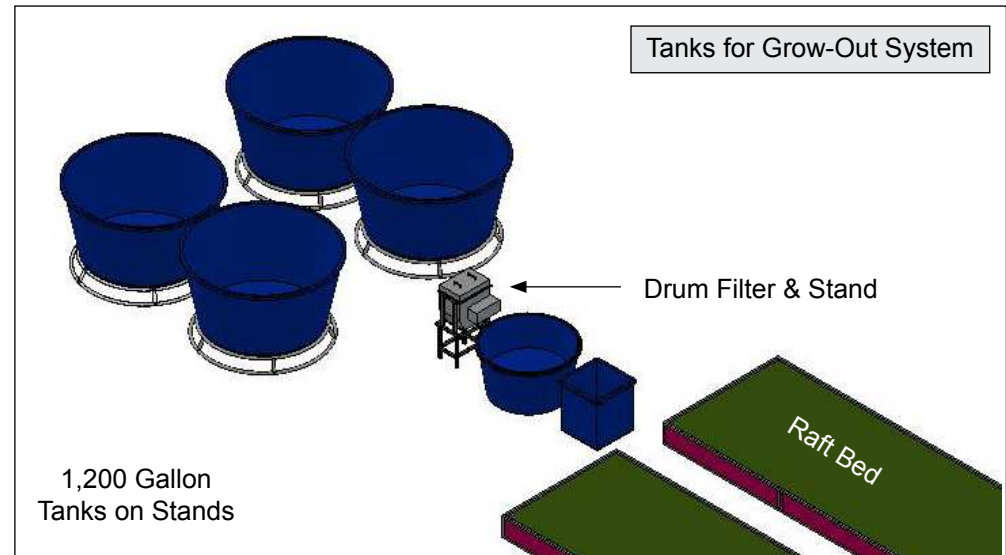
Side View



ATTENTION: For the four (4) 1,200 gallon tanks, drill one 3" hole in center of tank bottom to install the 112966 (2") bulkhead fitting assembly.

Also, drill one 3" hole in the side of each 1,200 gallon tank in location shown above. (Hole is for UniSeal® installation shown later in this section.)

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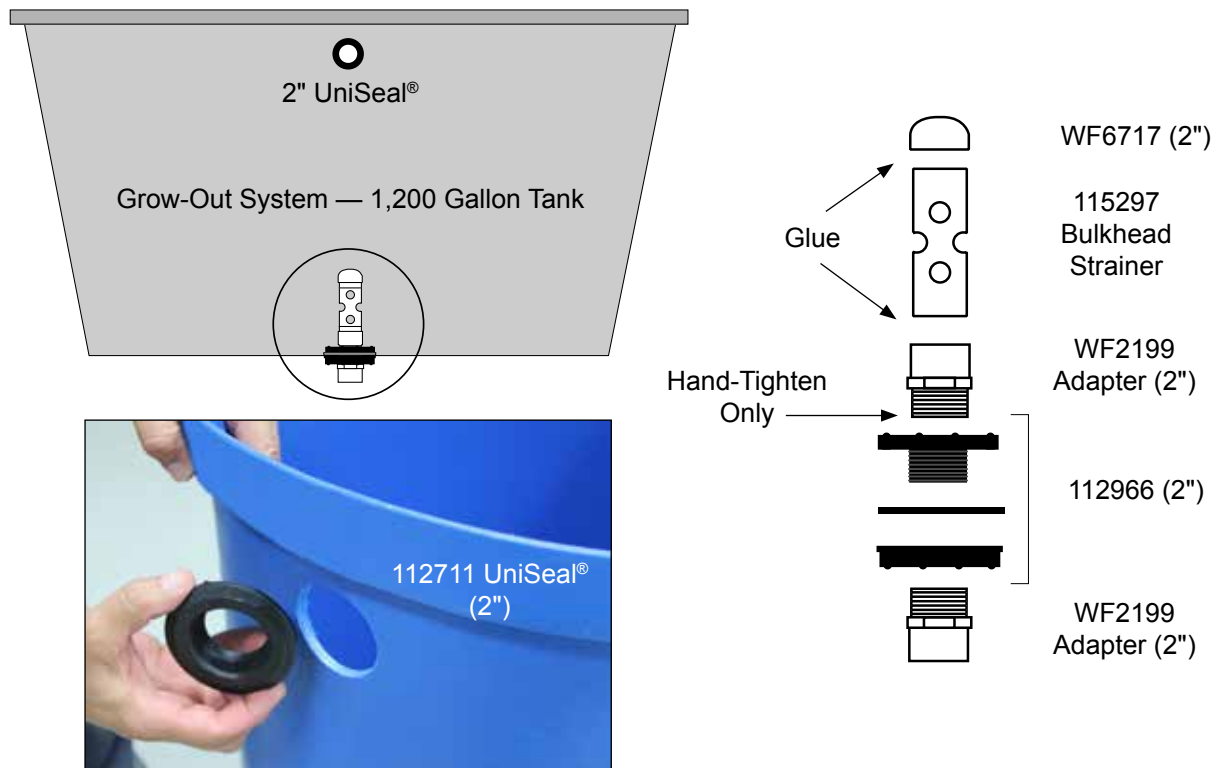


3

INSTALL BULKHEAD FITTINGS & UNISEALS®

4. Review diagrams below. Assemble and install bulkhead (drain hole/bottom) and bulkhead strainer and UniSeal® (side hole) fittings for the 1,200 gallon tanks.

NOTE: Tanks have a specific bulkhead assembly. Confirm that correct fittings are used when installing these fittings. *In most instances, adapters can be installed before bulkhead is attached to tank. Verify that bulkhead locknut fits over adapter before final assembly.*



Bulkhead Fitting Notes:

- Always install thick, rubber washer **inside tank**.
- Coat adapter threads with sealing compound before installation. Tighten until snug.
- If bulkhead fitting includes a thin, hard plastic washer, install that against locknut outside tank.
- Tighten all fittings until snug. **Do not overtighten!**

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Photos show a sample bulkhead assembly before it is slid into drain hole of a tank.



NOTE: Some bulkhead fittings include only a thick, rubber washer. Threads on fittings are reversed. **Actual tank design differs.**

3

PREPARE 410 & 140 GALLON TANKS FOR UNISEAL® INSTALLATION

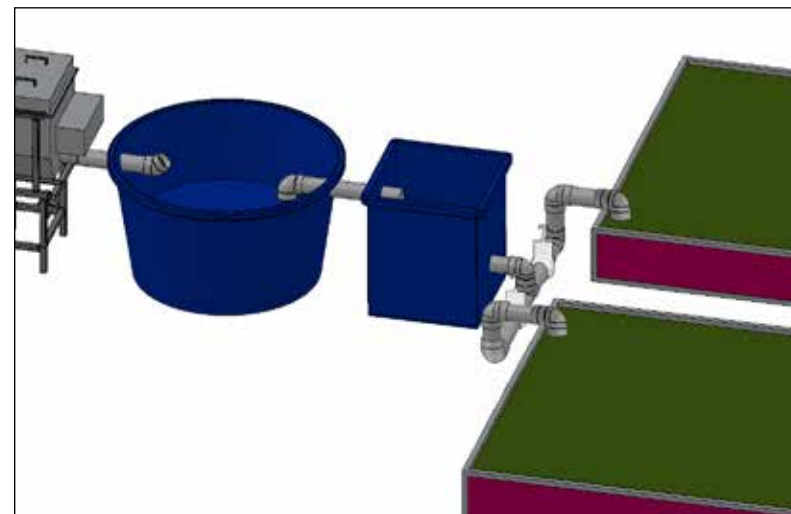
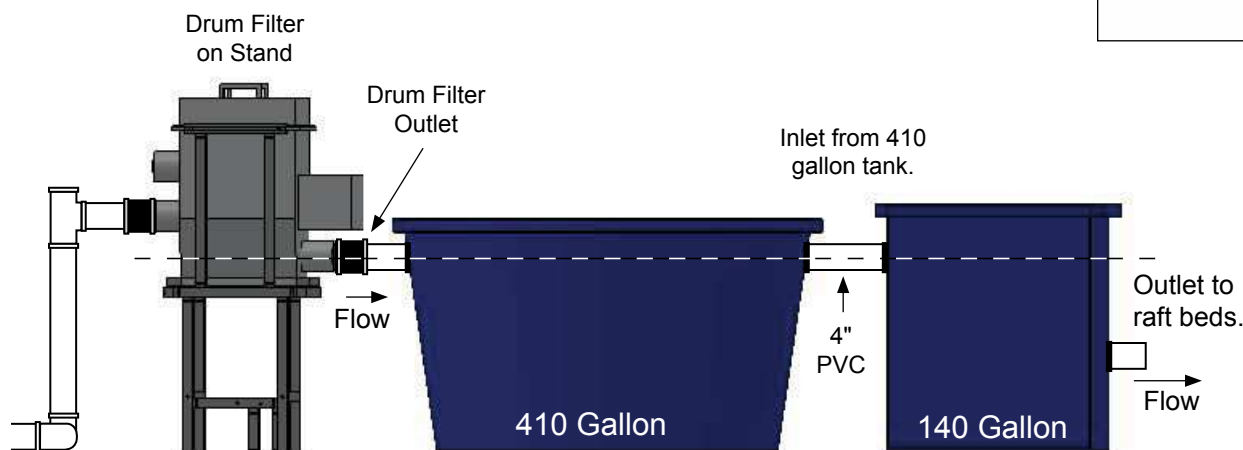
5. Set drum filter on drum filter stand (assembled in Section 1c) as shown.
6. Drill a 5" hole in the locations shown below to install 4" UniSeals®.

ATTENTION: For the 410 gallon and 140 gallon tanks, upper hole height to match outlet of drum filter. Use drum filter to position holes in tanks. Use pvc pipe and fittings to gauge outlet hole in 140 gallon tank.

NOTE: To prevent UniSeal damage and for easier installation, bevel end of pvc pipe, coat with dish soap, and then slide through seal.



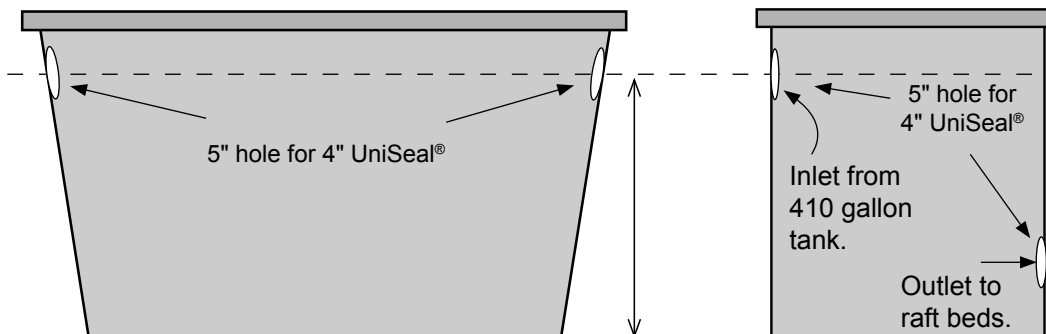
Bevel End to Install



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ATTENTION: For best results, set drum filter on drum stand to gauge position of outlet pipe to 410 gallon tank. Drum stand and tank should be level and positioned as they will be when system is in operation.



ATTENTION: For best results, dry fit pvc fittings and pipe to gauge position of outlet hole on 140 gallon tank. See diagram at top-right of this page. Plumbing runs out of tank to ground level and then to raft beds as shown. *Do not position hole too low on tank.*

3

INSTALL UNISEALS®

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112711 (2")
WF0011 (4")
UniSeals®

7. Press UniSeals® into pre-drilled holes from outside each tank*.

NOTE: Do not use sharp tools to install. Doing so can damage seal and tank surface. Lubricate with soapy water if needed.

8. After installation, inspect seal inside and outside tank to ensure seal collar is flush against tank surface.



*Sample tank shown above differs from actual tank. Installation of seal is the same.

Photo below shows installed UniSeal® and 4" outlet tube of 410 gallon filtration tank. Length of 4" pvc pipe depends on tank positions.



NOTE: To prevent UniSeal damage and for easier installation, bevel end of pvc pipe, coat with dish soap, and then slide through seal.



Bevel End to Install

Grow-Out System: Install Drain Plumbing & Standpipes

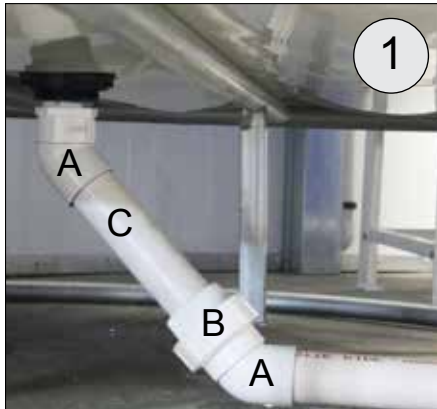
3a

INSTALL DRAIN PLUMBING & STANDPIPES

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Once main tanks are set in permanent positions, assemble drain plumbing and external standpipes. With the exception of end fittings, each 1,200 gallon tank includes assemblies 1 & 2 shown below.

ATTENTION: Before assembly, coat all slip and pipe connections with pvc primer and pvc glue according to instructions on primer and cement containers. *Dry fit all connections before final assembly.*

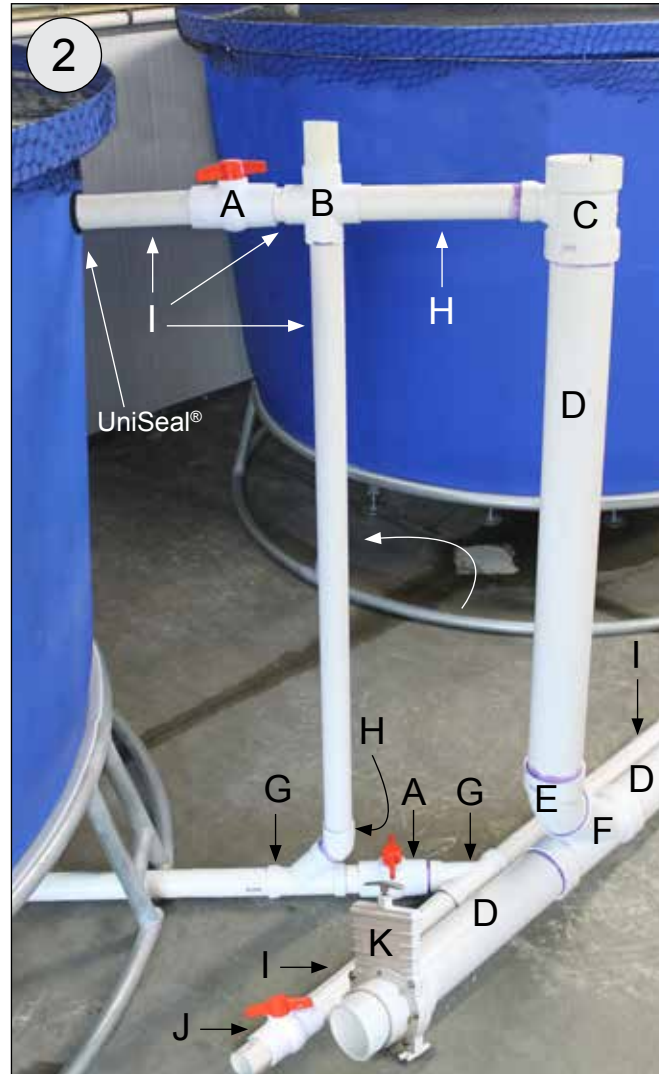


1 Drain pipe (2") assembly for 1,200 gallon tank:

A: 112758 45° Elbow (2")
B: WF0002 2" Union
C: Section of 2" pvc pipe (length as needed to reach floor when assembled)

1. Build four (4) drain assemblies as shown—one for each 1,200 gallon tank for grow-out system.

2. Attach drain assemblies to bulkhead fitting of tank.



2 Standpipe assemblies (2" & 4") for 1,200 gallon tanks:

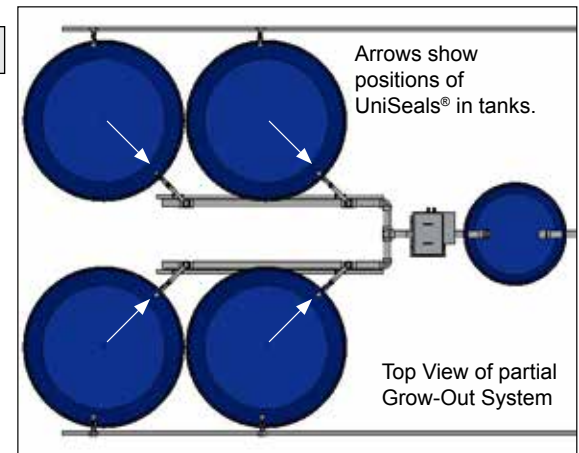
A: WF3516 (2") Ball Valve
B: WF0003 (2") Cross
C: WF0004 (4" x 4" x 2") Tee Fitting
D: Section of 4" pvc pipe (cut-to-length as needed)
E: WF0006 (4") 45° Elbow
F: WF0005 (4") Wye Tee
G: 112759 (2") Wye Fitting
H: 112758 45° Elbow (2")
I: Section of 2" pvc pipe (cut-to-length as needed)
J: WF3516 (2") Ball Valve: Installed at each end of the two 2" drain pipes. (See diagram on next page.)
K: WF3330 (4") Gate Valve. (See diagram on next page.)
L: WF1576 (2") 90° Elbow. (See diagram on next page.)

NOTE: Connect all 2" slip-to-slip fittings using short sections of 2" pvc pipe. **Install 2" horizontal tube level; install vertical standpipes plumb.**

1. Build four (4) assemblies as shown—one for each 1,200 gallon tank for grow-out system. Only the end of each 2" / 4" tube includes J & K valves. See next page.

ATTENTION: Dry fit assemblies for best results when possible before final assembly with glue.

2. Verify that UniSeal® in tank is positioned as needed to attach pipe assembly. See diagram at top of this page.

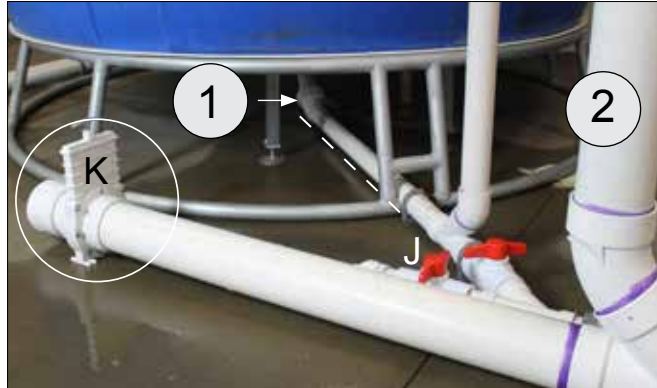


3b

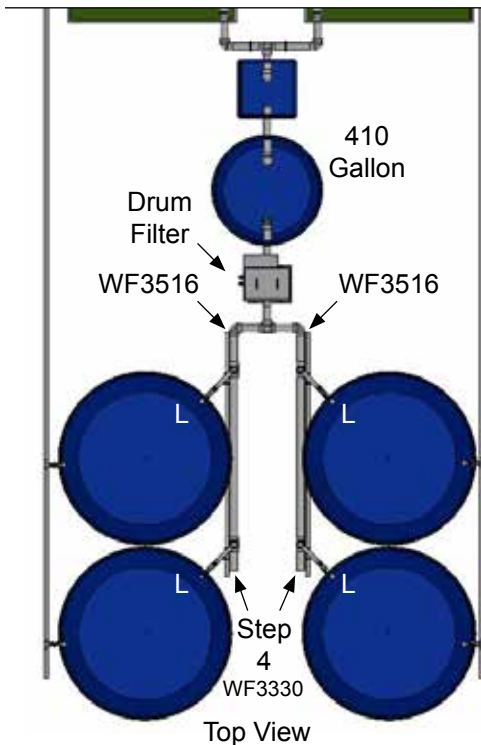
INSTALL DRAIN PLUMBING & STANDPIPES—continued

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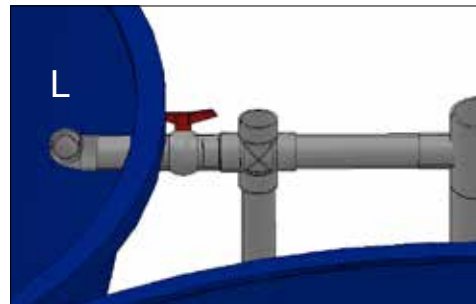
3. Connect drain assembly (#1) to standpipe assembly (#2).



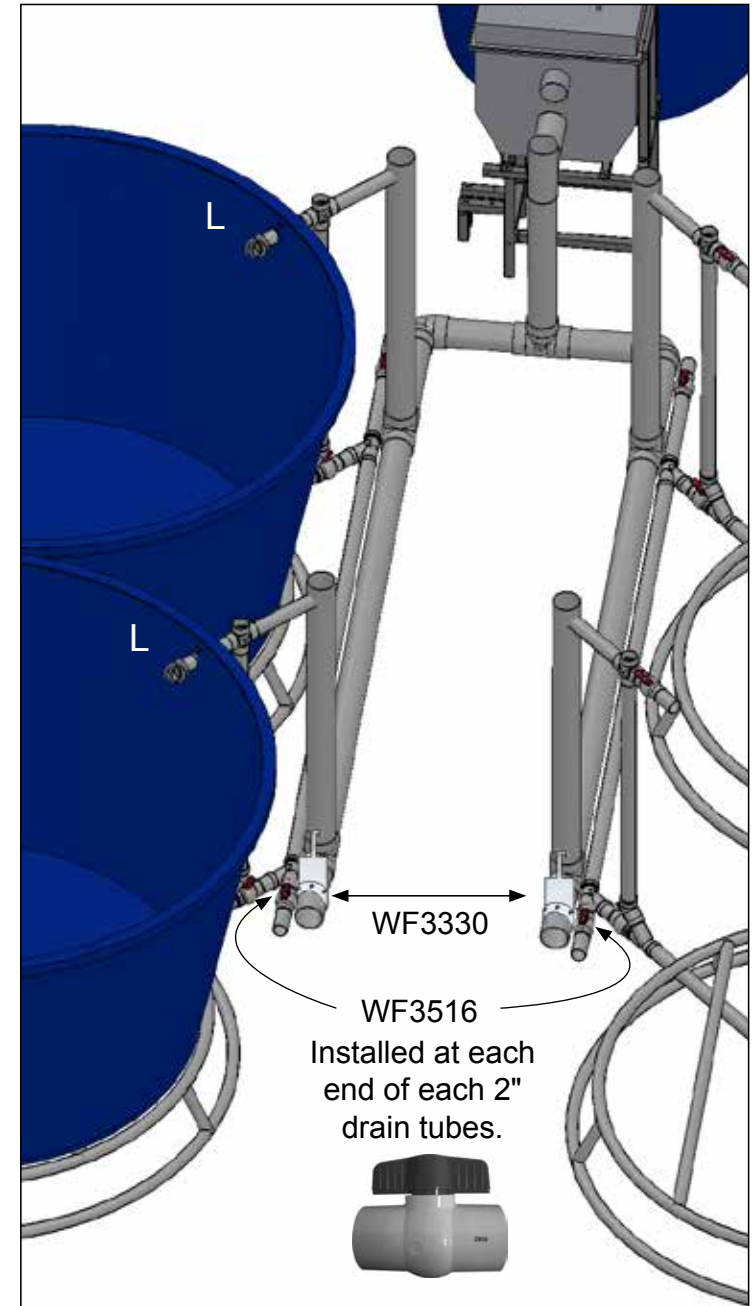
4. Install WF3516 ball valve (J) at each end of 2" drain tube. Install a WF3330 gate valve (K) at end of each 4" drain tube opposite drum filter and 410 gallon filtration tank.



5. Install a 90° elbow (WF1576) at end of each external standpipe assembly *inside tank*. See letter **L** in diagrams.



NOTE: For adjustment, **do not glue** elbow to horizontal pipe of external standpipe. Angle elbow up at 60° or so to help skim feed, floating waste, and other matter from surface. Adjust angle as needed when system is fully functional.



Grow-Out System: Attach Drum Filter

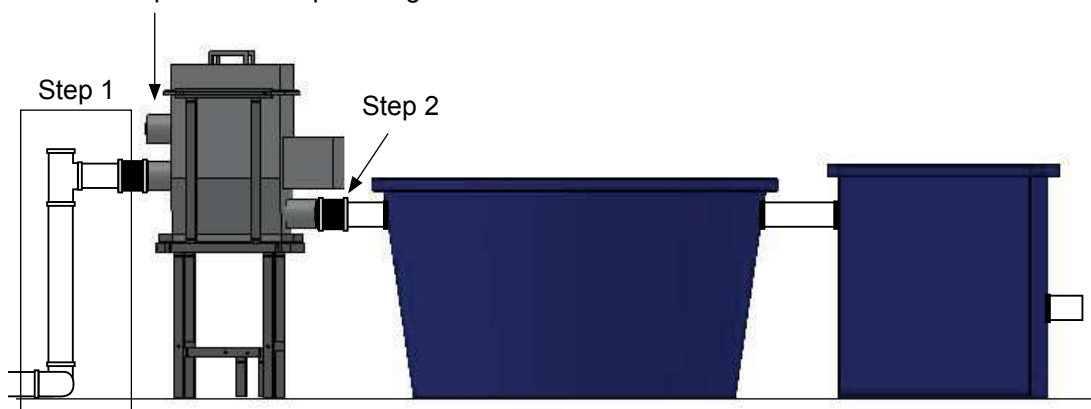
3c

CONNECT 4" DRAIN MANIFOLD TO DRUM FILTER

Complete these steps:

1. With drum filter on drum stand in desired position, connect 4" drain lines from 1,200 gallon tanks to inlet port of filter using Fernco® fitting.
2. Slide 4" pvc pipe into UniSeal® of 410 filtration tank and connect to outlet of drum filter using Fernco® fitting.

Step 3: Connect plumbing and direct to floor drain.

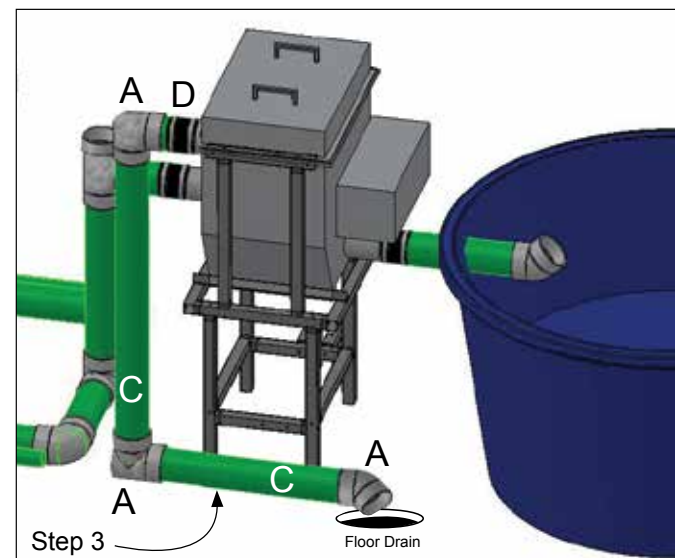
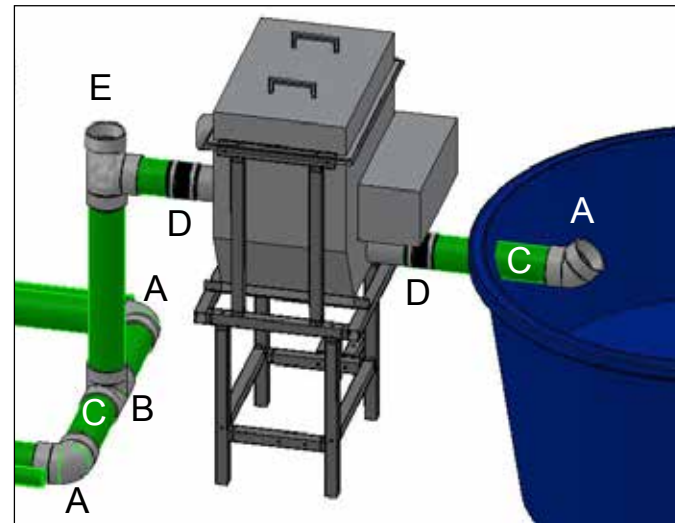


3. Connect 4" pvc pipe and fittings to upper port of drum filter and direct discharge water to floor drain. See lower diagram – right.

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4" Drain Pipe to Drum Filter Connections:

- A: WF0007 (4") 90° Elbow
- B: WF0008 4" Slip x Slip x Slip Tee
- C: Section of 4" pvc pipe (cut-to-length as needed)
- D: WF0010 4" Fernco® Fitting
- E: WF0009 4" Sanitary Tee



3c

INSTALL HIGH PRESSURE RINSE PUMP AND CONTROL PANEL

Once drum filter is connected, install control panel for operation (below) and high pressure pump for rinse cycle (right). Read all documentation included with drum filter to properly install components. See electrician note at right.



WARNING: Enlist the services of an experienced electrician when connecting power to drum filter control panel and high pressure pump.

All wiring to be completed according to established codes and practices. Consult the services of a qualified electrician.

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NOTE: Use fasteners included with drum filter stand to secure control panel and pressure pump to stand. Review fastener details in Section 1c.



Connect water supply hose to top of pump.

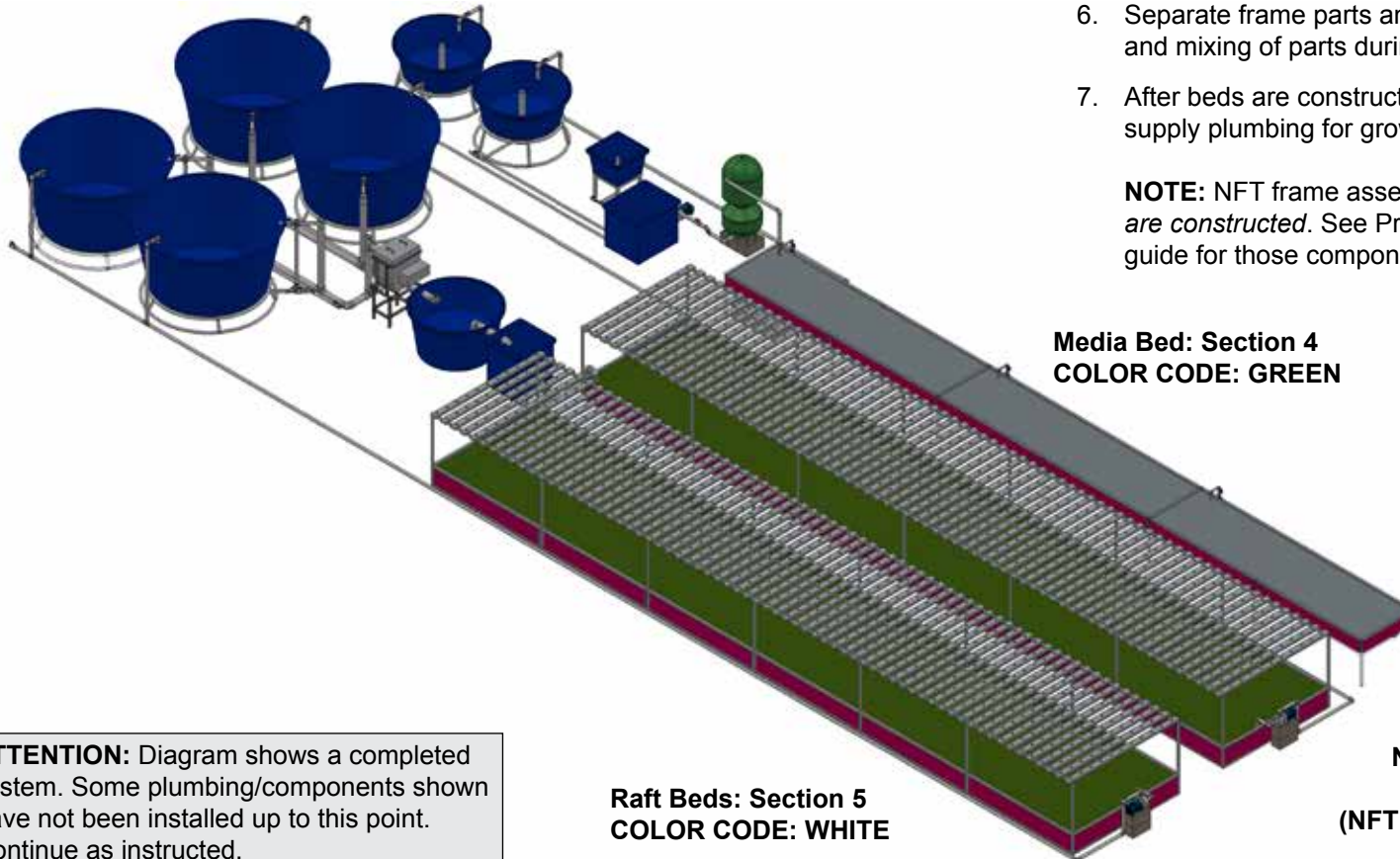
Construction of Media and Raft Beds



At this point (if progressing through this manual), the assembled system should include these items:

- **Fingerling System:** Tanks set, bead filter assembled, and all drain plumbing installed and connected to inlet port at bottom of bead filter.
- **Grow-Out System:** Tanks set, drum filter on stand in position, and all 2" and 4" drain and standpipes installed, connected, and complete to outlet of 140 gallon sump.
- **NFT System Over Raft Beds:** This part of the system is assembled and installed *after* raft bed construction is completed.

Use layout diagram below to construct media and raft beds in locations shown.



ATTENTION: Diagram shows a completed system. Some plumbing/components shown have not been installed up to this point. Continue as instructed.

Follow these general steps when constructing beds:

1. To minimize possible damage to liners, install all fans, heaters, and lighting (including wiring) that will be positioned above raft and media beds **before** assembling these beds.
2. Frames cannot be moved once assembled. Take the necessary steps to keep frames square during assembly.
3. Clear site of debris and obstacles that could hamper construction progress.
4. Level the surface where raft beds will be located.
5. Read assembly steps for media and raft beds to better understand which parts are for each.
6. Separate frame parts and set aside to prevent confusion and mixing of parts during construction.
7. After beds are constructed, continue by installing the supply plumbing for grow-out and fingerling systems.

NOTE: NFT frame assembly can also occur *after* raft beds are constructed. See Procedure 14 near the end of this guide for those components and steps.

Media Bed: Section 4
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Raft Beds: Section 5
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NFT System: Section 14
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(NFT system is above raft beds.)

Fingerling System: Media Bed Diagrams

4

MEDIA BED DIAGRAMS

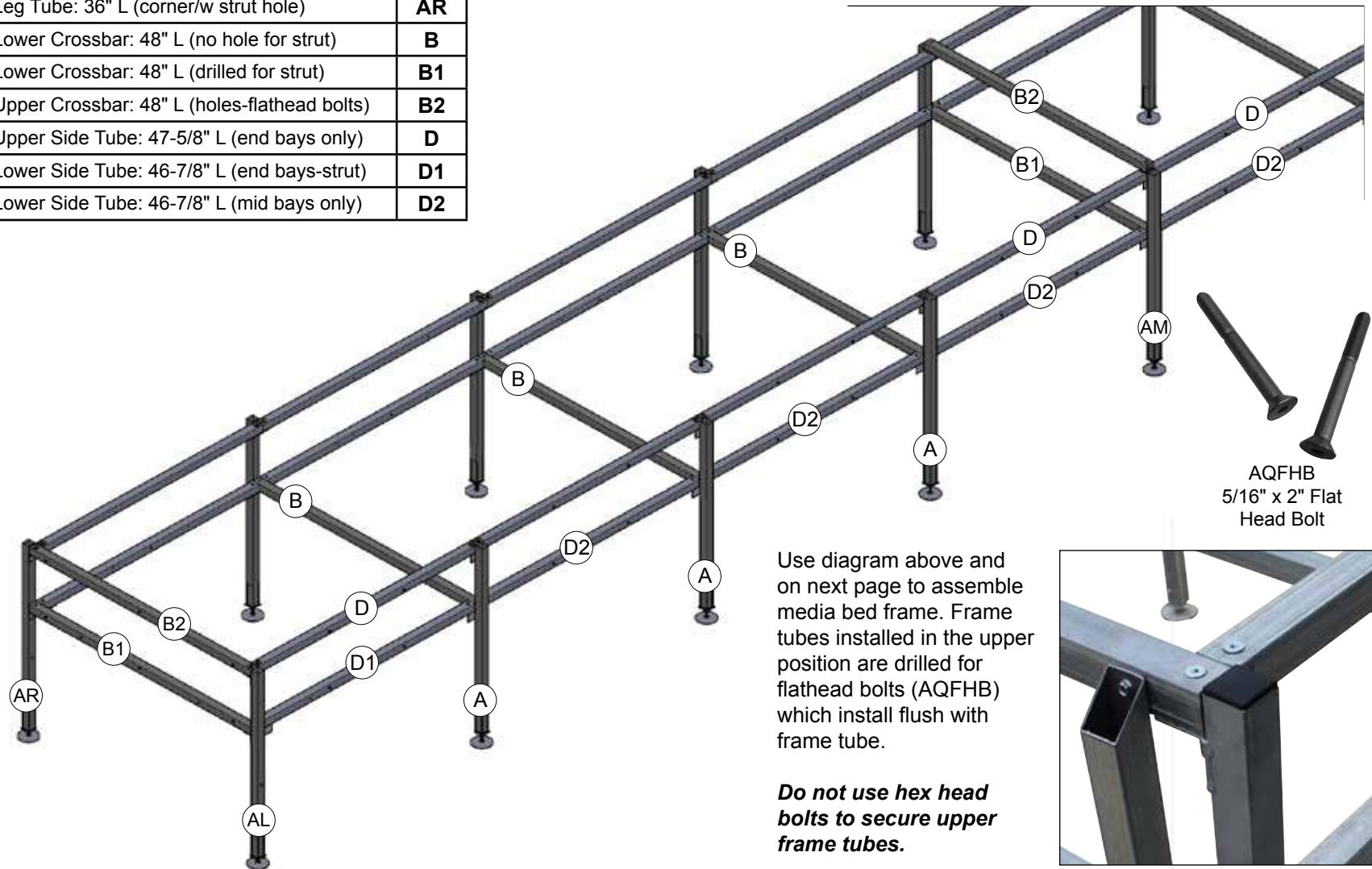
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Part #	Description	ID #
AQ003A	Leg Tube: 36" L (mid frame/no strut hole)	A
AQ003AM	Leg Tube: 36" L (mid frame/w strut hole)	AM
AQ003AL	Leg Tube: 36" L (corner/w strut hole)	AL
AQ003AR	Leg Tube: 36" L (corner/w strut hole)	AR
AQ003B	Lower Crossbar: 48" L (no hole for strut)	B
AQ003B1	Lower Crossbar: 48" L (drilled for strut)	B1
AQ003B2	Upper Crossbar: 48" L (holes-flathead bolts)	B2
AQ003D	Upper Side Tube: 47-5/8" L (end bays only)	D
AQ003D1	Lower Side Tube: 46-7/8" L (end bays-strut)	D1
AQ003D2	Lower Side Tube: 46-7/8" L (mid bays only)	D2

Media bed frames designed in 16' sections are connected to form one complete assembly. Once frame is constructed, each 16' section is then insulated and lined. Use diagrams and information in this section to assemble media bed.

Use table information to identify frame tubes and frame position. For easier assembly, attach adjustable mounting feet to all leg tubes first. See diagram on next page.

ATTENTION: Review all information in this section **before** you begin.



4a

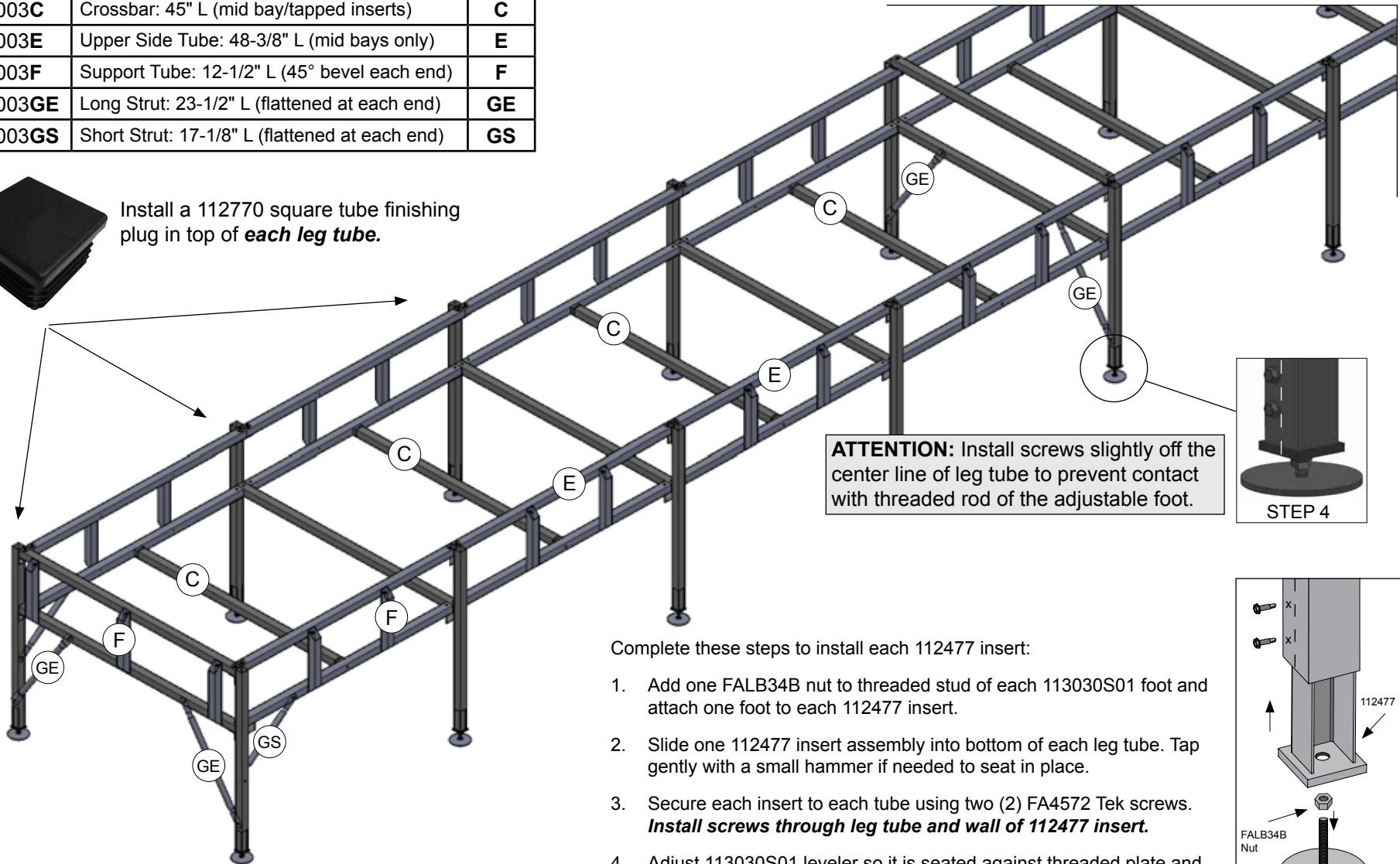
ASSEMBLE MEDIA BED

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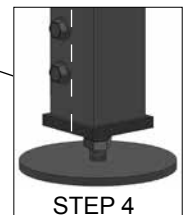
Part #	Description	ID #
AQ003C	Crossbar: 45" L (mid bay/tapped inserts)	C
AQ003E	Upper Side Tube: 48-3/8" L (mid bays only)	E
AQ003F	Support Tube: 12-1/2" L (45° bevel each end)	F
AQ003GE	Long Strut: 23-1/2" L (flattened at each end)	GE
AQ003GS	Short Strut: 17-1/8" L (flattened at each end)	GS



Install a 112770 square tube finishing plug in top of **each leg tube**.

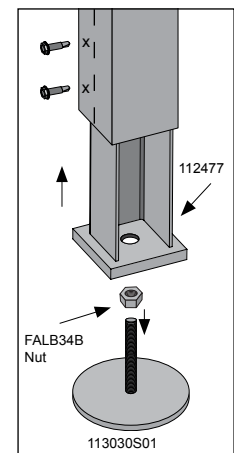


ATTENTION: Install screws slightly off the center line of leg tube to prevent contact with threaded rod of the adjustable foot.



Complete these steps to install each 112477 insert:

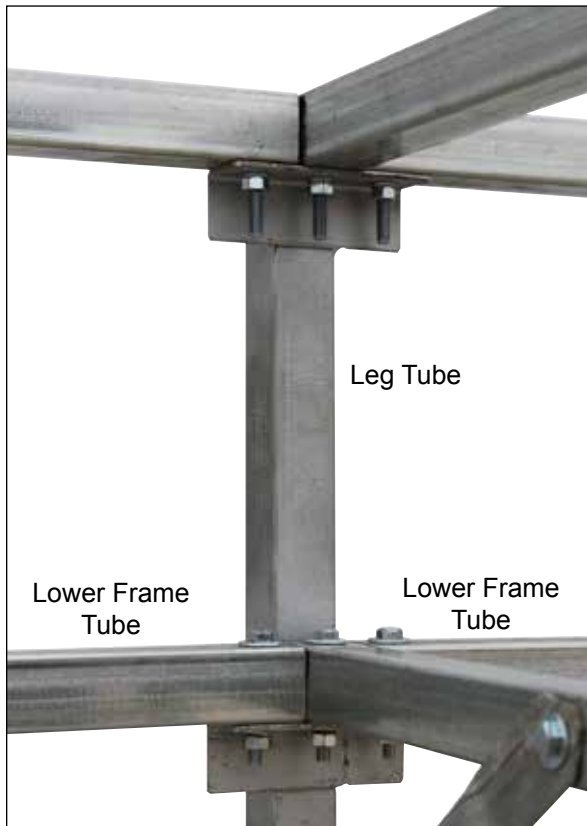
1. Add one FALB34B nut to threaded stud of each 113030S01 foot and attach one foot to each 112477 insert.
2. Slide one 112477 insert assembly into bottom of each leg tube. Tap gently with a small hammer if needed to seat in place.
3. Secure each insert to each tube using two (2) FA4572 Tek screws. **Install screws through leg tube and wall of 112477 insert.**
4. Adjust 113030S01 leveler so it is seated against threaded plate and nut. See diagram to the right.



4a

ASSEMBLE MEDIA BED—continued

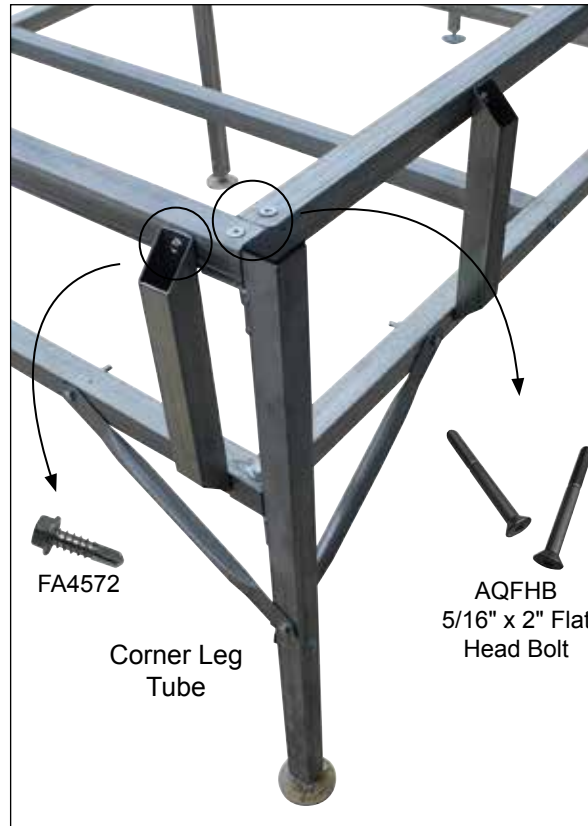
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Secure lower frame tubes to all leg tubes using:

- FAG336B (5/16" x 2 1/2") hex head bolts
- FALB02B (5/16") nuts
- FAME07B (5/16") flat washers
- FAMA07B (5/16") lock washers

NOTE: Install flat washers against bolt head. Install lock washers against nuts.



Secure upper frame tubes to all leg tubes using:

- AQFHB (5/16" x 2 1/2") flat head bolts
- FALB02B (5/16") nuts
- FAMA07B (5/16") lock washers

Secure short vertical support tubes:

- FA4572 Tek Screws



Secure struts to frame tubes using:

- FAG336B (5/16" x 2 1/2") hex head bolts
- FALB02B (5/16") nuts
- FAME07B (5/16") flat washers
- FAMA07B (5/16") lock washers

NOTE: Use two (2) flat washers per bolt – one on each side of tube.

4a

ASSEMBLE MEDIA BED—continued

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Level and Square Assembled Media Bed Frame

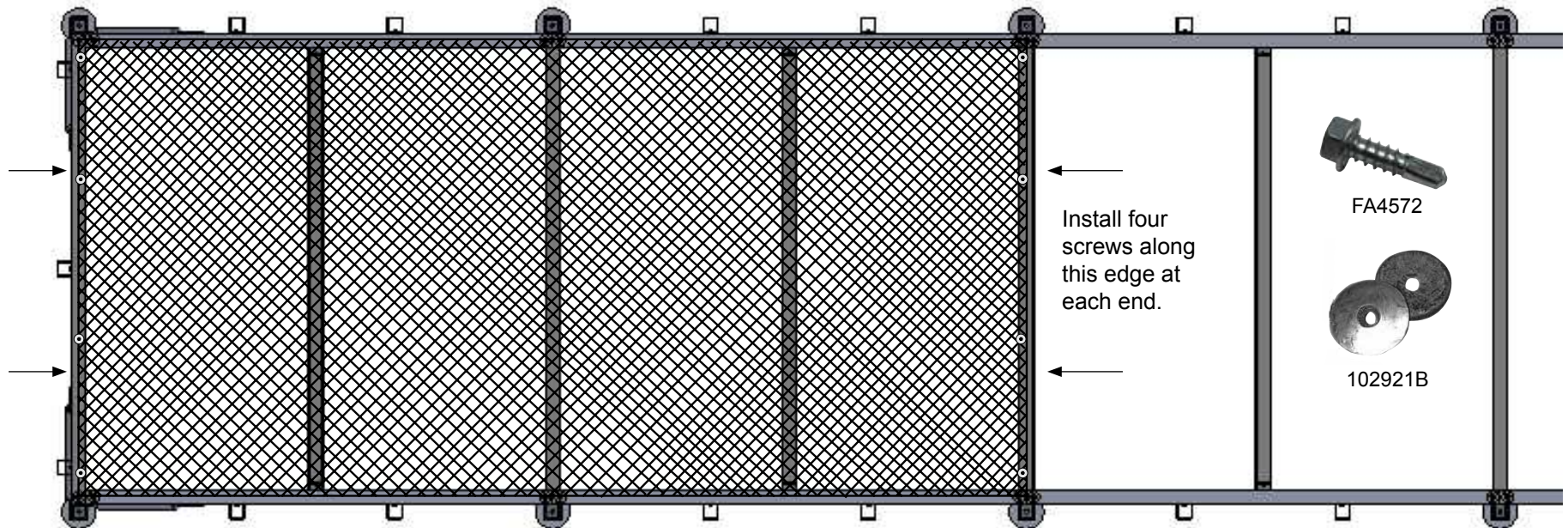
Use a string line, level, or other leveling tools (or methods) to ensure assembled frame is level side-to-side and end-to-end throughout frame length. Adjust leveling feet as needed to level frame. **Measure diagonally corner-to-corner of each 16' section to ensure frame is square before installing expanded metal.**

Install 4' x 8' Expanded Metal Panels

1. With assistance, carefully place a 4' x 8' expanded metal panel onto the horizontal cross tubes.

ATTENTION: Wear gloves and eye protection when handling panels. **Panel edges are sharp!**

2. Ensure that panel is positioned over a cross tube at each end. **Do not allow panel to drop off cross tube.**
3. Secure each panel end to cross tube using four (4) FA4572 Tek screws and 102921B neo-bonded washers. **Secure ends only. Do not secure panel sides.**



4a

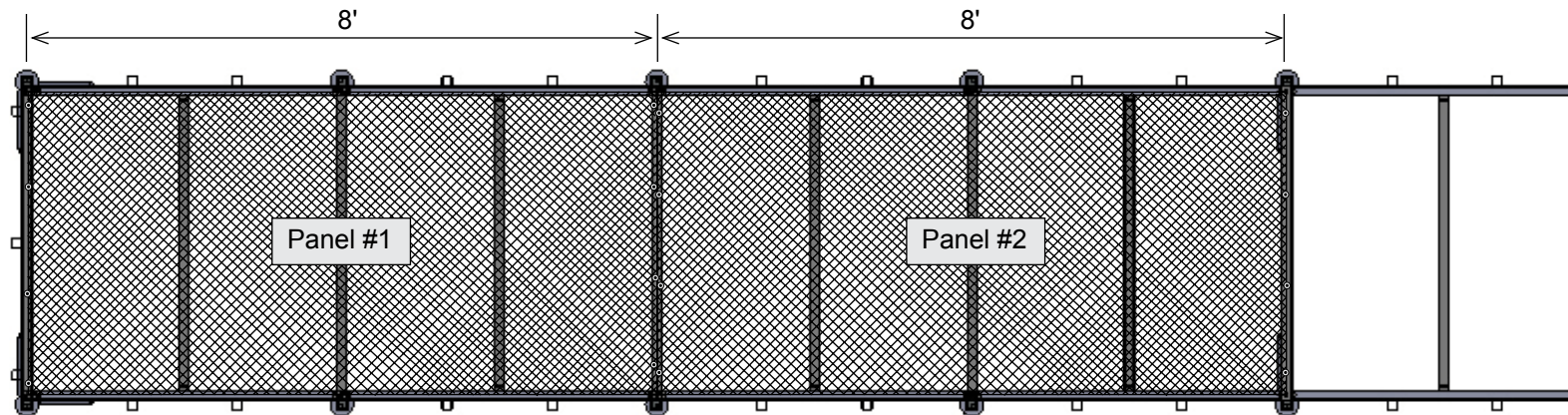
ASSEMBLE MEDIA BED—continued

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- Set next expanded metal panel into place and secure as previously described.

NOTE: Overlap metal panel end with adjacent panel if needed. In all instances, *ensure that both ends remain on the cross support tube*.

- Repeat to install and secure all remaining expanded metal panels.



- Continue by cutting a hole for liner drains as shown in next section.

4b

CUT HOLES FOR LINER DRAIN

As mentioned, media bed is divided into 16' sections. After installing expanded metal, cut a hole in each 16' section for each bed liner drain fitting. Use the diagrams below when marking drain hole position. Complete these steps:

1. Determine at which end to position the media bed reservoir. This is typically the pump end of system. Entire media bed will drain toward reservoir when assembled and filled.
2. Mark center of drain hole on expanded metal bed panel.

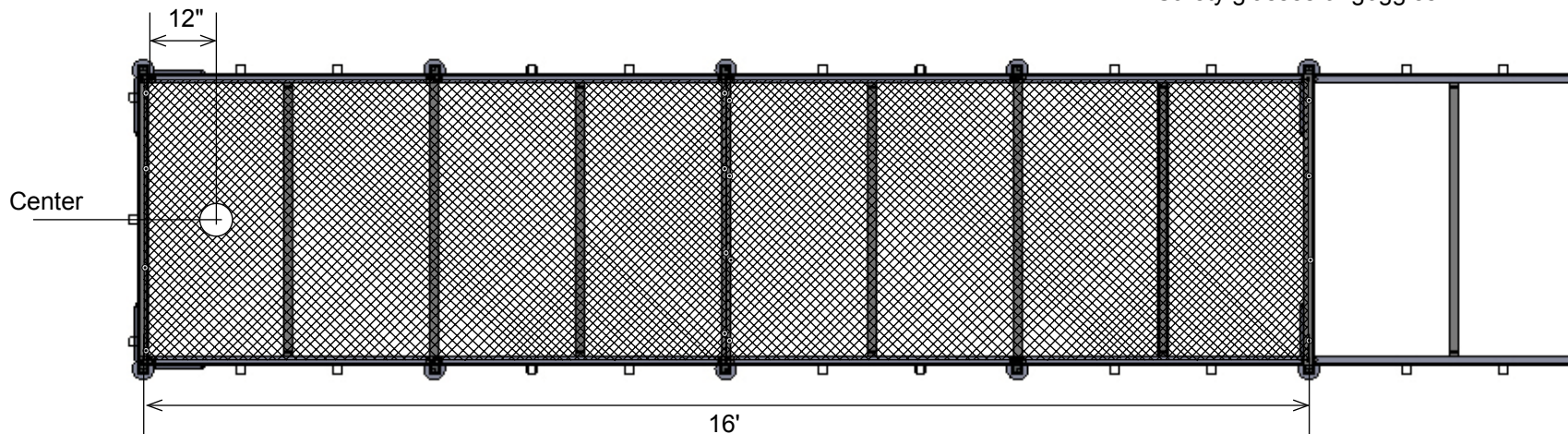
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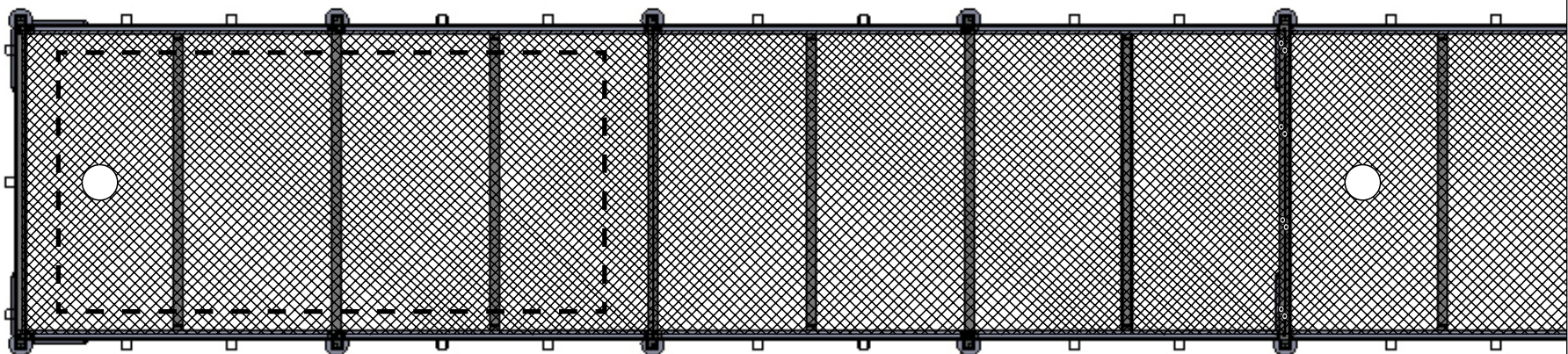
CAUTION! Wear safety glasses and gloves when working with expanded metal panels.

Required:

- Hand-grinder with metal-cutting attachment.
- AQ003I PolyCor washer (for template).
- Tape measure and marker.
- Safety glasses or goggles.



ATTENTION: Dashed line (below) shows position of reservoir under media bed frame when system is fully assembled. Media beds drain to reservoir.



4b

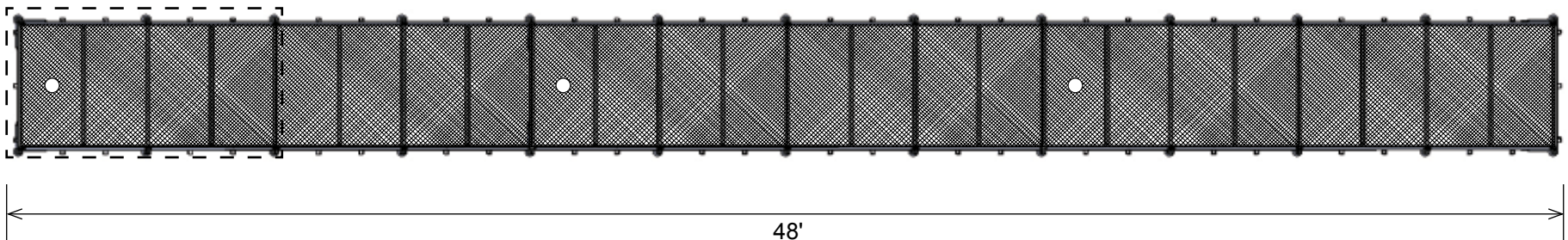
CUT HOLES FOR LINER DRAIN—continued

COLOR CODE: GREEN



CAUTION! Wear safety glasses and gloves when working with expanded metal panels.

3. Using a hand-grinder or similar cutting tool, cut a 6" diameter hole through the expanded metal panel. **To prevent injury, do not use any hole saw bit.**



NOTE: Example above shows a 48' media bed with expanded metal panels installed. Holes allowing access for liner drain fittings are also shown.

4. After cutting an opening for liner drain fittings, install insulation and liner.

4c

INSTALL INSULATION BOARD AND DRILL DRAIN HOLES

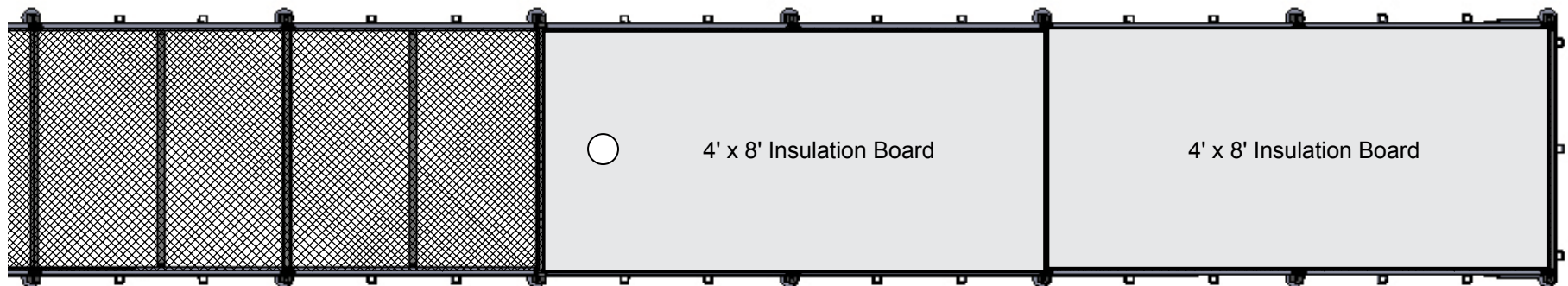
Complete these steps to install insulation board:

1. Set first two sections of 4' x 8' insulation board on expanded metal bed.



NOTE: Photo above (left) shows insulation board installed at one end of assembled media bed frame.

2. Slide under assembled frame and mark drain hole position on underside of insulation board using hole in expanded metal panel as a guide.
3. Take a 6" hole saw bit (not included) or hand saw and cut a 6" hole in the insulation board as shown.



Step 2

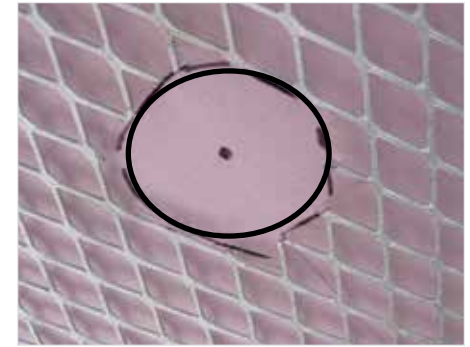


Photo (above left) shows using a hole saw bit to mark hole position.

Remove panel (if desired) to drill hole, then set panel back in place.

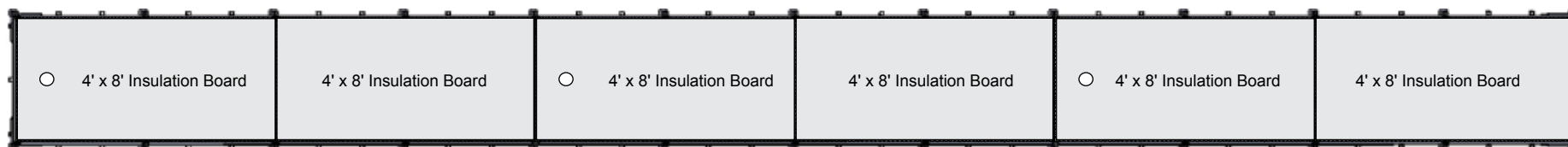
ATTENTION: Bit is used to cut hole in insulation, not expanded metal. That procedure was completed in a previous section.

4c

INSTALL INSULATION BOARD AND DRILL DRAIN HOLES — continued

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- Repeat to install all remaining 4' x 8' sections of insulation to cover expanded metal panels and drill remaining drain holes in insulation. Drill only one drain hole for each 16' section of media bed frame. Use hole in expanded metal as a guide.



- Install all side sections of insulation board. Use scrap sections of insulation board when possible.



- To prepare for liner installation, vacuum beds to remove all debris from insulation and continue.

4d

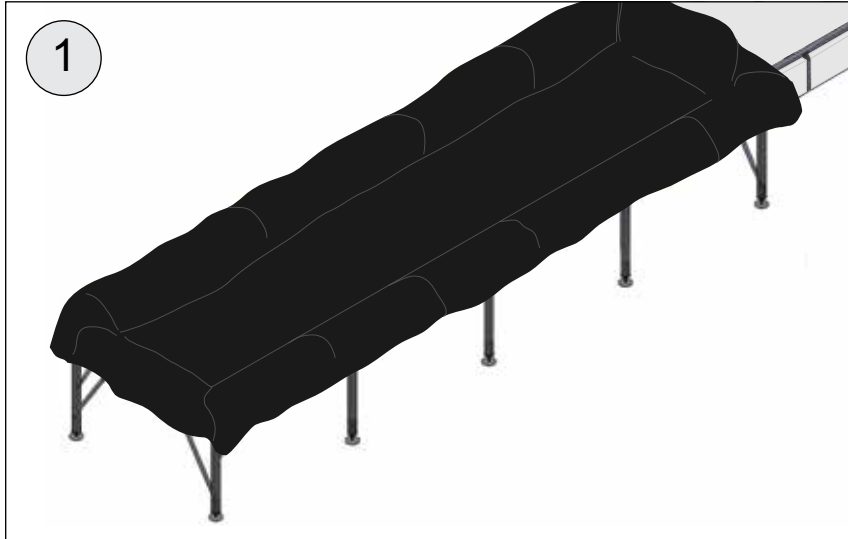
INSTALL LINERS

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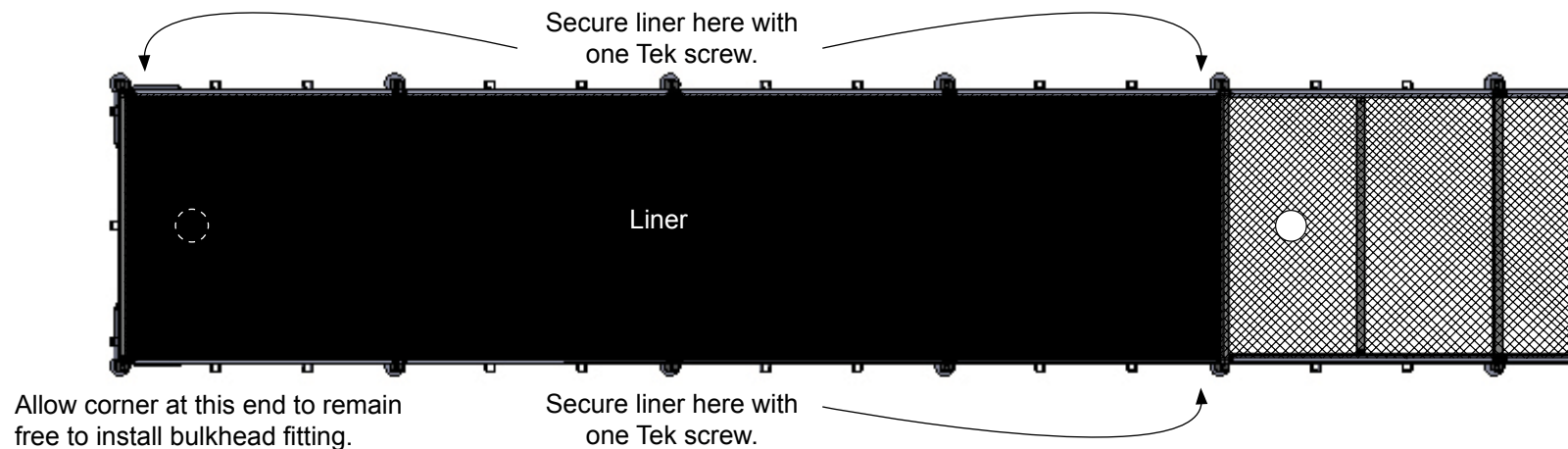
ATTENTION: During liner installation, do not drop tools or sharp objects into liner bed. Doing so can puncture liner! Exercise caution!

Complete these steps to install one (1) media bed liner. (Repeat steps to install all remaining liners.)

1. Take one 113389 media bed liner and carefully place it into one 16' section of the assembled media frame.



2. Center liner in frame, carefully fold corners so liner rests against insulation on bottom and sides, and temporarily secure liner using a Tek screw at three (3) corners. See diagram 2. **Allow one corner to remain free at the end where drain fitting hole is located in insulation and expanded metal.**



Fingerling System: Install Media Bed Liner Bulkhead Fitting Assembly

4e

PREPARE LINER AND INSTALL BULKHEAD FITTING

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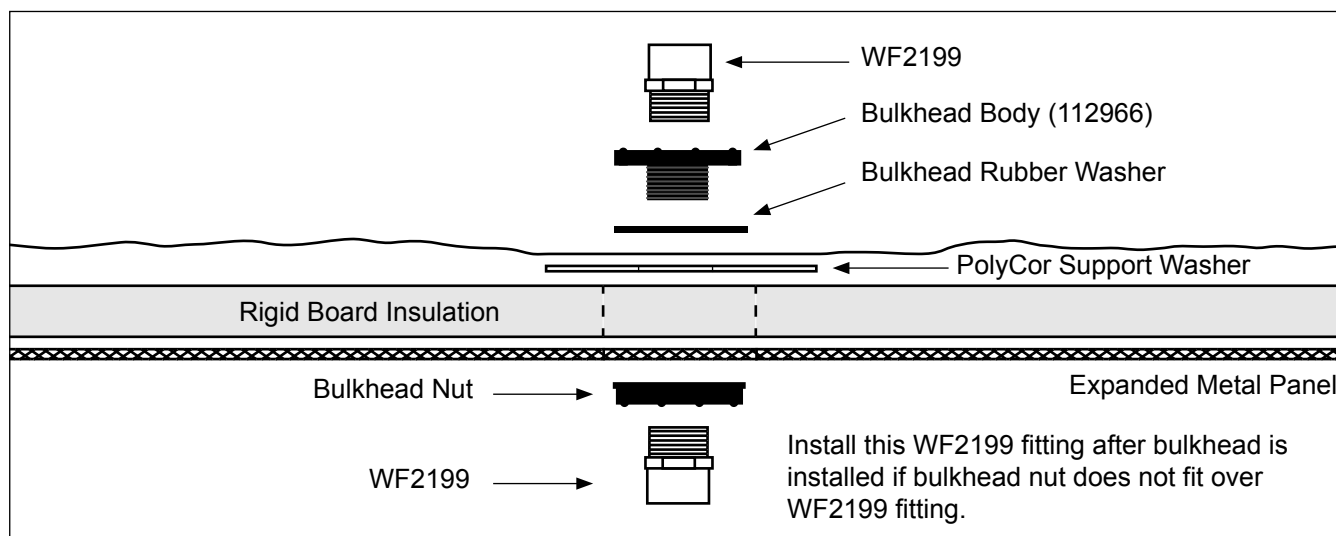
Complete these steps to install one 2" bulkhead fitting for a liner. Repeat these steps to install a bulkhead fitting for each remaining media bed liner.

1. Take one 2" bulkhead fitting and disassemble. Take two (2) WF2199 2" adapters, apply thread sealant, and attach to main body of bulkhead. Tighten fittings until snug. *Do not overtighten.*

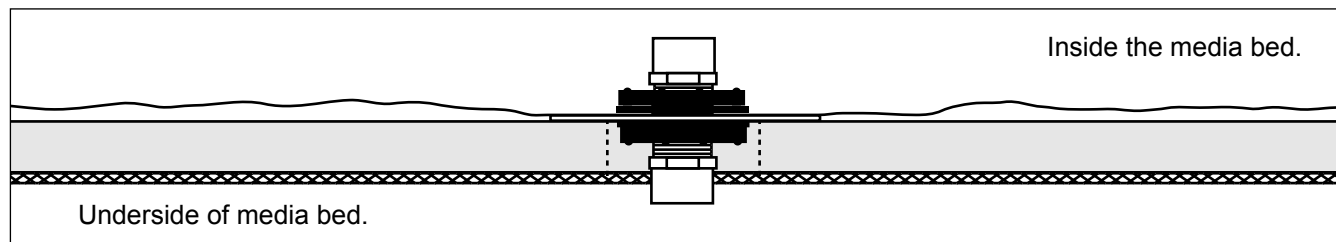


NOTE: Verify that nut of bulkhead fits over the 2" adapter before attaching adapter to bulkhead body. *If it does not, install the outer adapter—the one that will be outside the bed liner once fitting is installed—after attaching bulkhead to liner.*

2. Use the diagrams and procedure below and on the next pages to install fitting assembly.



ATTENTION: During installation, turn only the bulkhead nut to tighten fitting. Hold main bulkhead body steady to prevent turning.



4e

PREPARE LINER AND INSTALL BULKHEAD FITTING — continued

COLOR CODE: BLUE



a. Lightly press liner to reveal outline of hole.



b. Mark hole using a paint marker or similar tool.



c. Mark center of hole.



d. Align center of support washer with center mark.



e. Use washer as a template to mark fitting position.



f. Check marks to ensure proper position.



g. Use a utility knife to carefully cut center mark.



h. Use a scissors to cut fitting hole in bed liner.



i. Check position and remove loose material.



j. Lift liner material to access underside.



k. Slide support washer between liner and insulation.



l. Slide rubber washer over fitting threads and insert assembly through liner.

4e

PREPARE LINER AND INSTALL BULKHEAD FITTING — continued

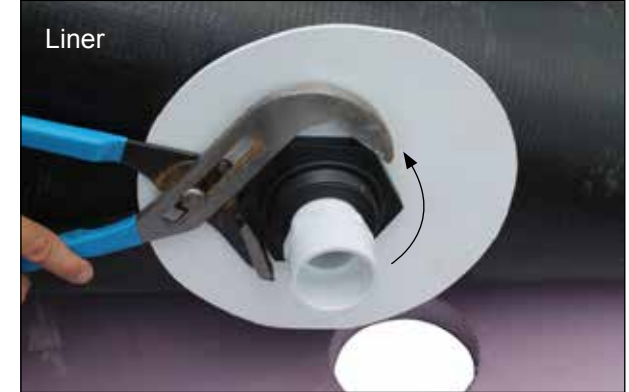
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- m. Carefully lift liner again and hold support washer in position.



- n. Install bulkhead nut.



- o. While holding main body of bulkhead, carefully tighten nut. **Do not allow bulkhead to turn.** Nut should be snug tight to prevent leaks.



- p. Reposition fitting and liner as needed to set assembly through access hole.

NOTE: Photo above shows fitting and inside surface of liner.



- q. Check underside of media bed to ensure that fitting assembly is fully inserted through hole in insulation and expanded metal.

NOTE: Liner should rest tightly against insulation board. (Expanded metal panel is not shown.)



- r. Continue by securing liner to media bed frame.

4f

ATTACH LINER TO MEDIA BED FRAME

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Required parts:

- 110155 Pre-Drilled Aluminum Bar Stock
- FA4572 Tek Screws and 100442 Nut Setter

After installing bulkhead fittings, secure liners to media bed frames. Media bed liners attach to frame in the same manner as raft bed liners attach to frame. Consult Section 5d if needed to attach media bed liners.

ATTENTION: There are enough Tek screws to install one in each hole of the aluminum stock. However, to reduce assembly time and labor, installing one in every other hole will serve to secure liner.



Photo above shows installing aluminum bar and Tek screws to secure liner.

ATTENTION: Take the necessary steps to prevent metal shavings from dropping inside media bed.



At crossbar between bed liners, overlap liners before installing aluminum bar and Tek screws.

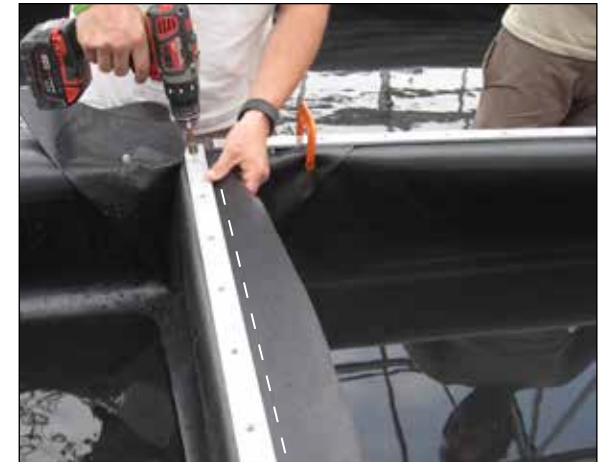


Photo shows securing adjacent liners to same crossbar. Trim liner material as needed once material is secure. See dashed line above.

ATTENTION: Exercise caution! Do not cut liner that is under top liner when removing excess material. Use a scissors and cut slowly.

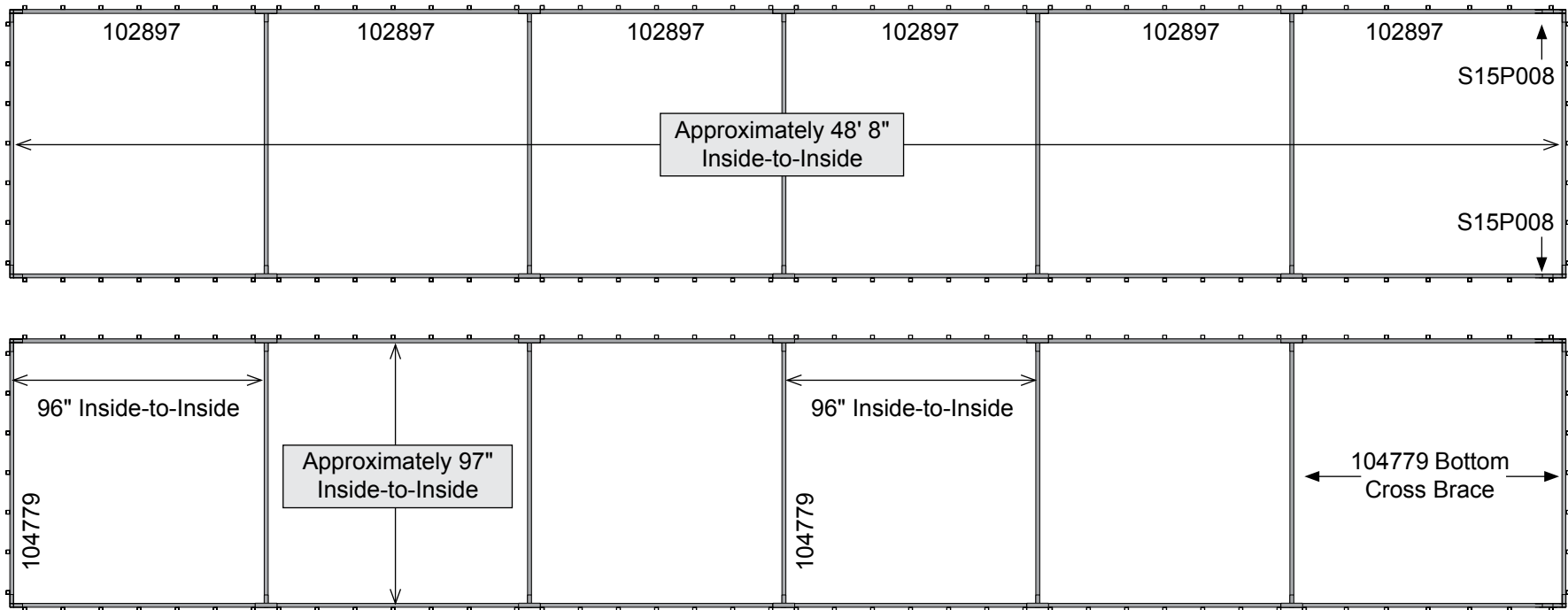
ADDING CLAY PEBBLES: Add the 112933 clay pebbles to the media beds after testing the system and checking for leaks. At that time, divide the bags of clay pebbles evenly among the different sections of the media bed.

Grow-Out System: Raft Bed Diagrams

5

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Diagrams below show layout of assembled 48'-8" raft beds. Use these diagrams and dimensions as guides during raft bed frame assembly. The inside-to-inside length dimension allows room for 4" plumbing pipes at each end.

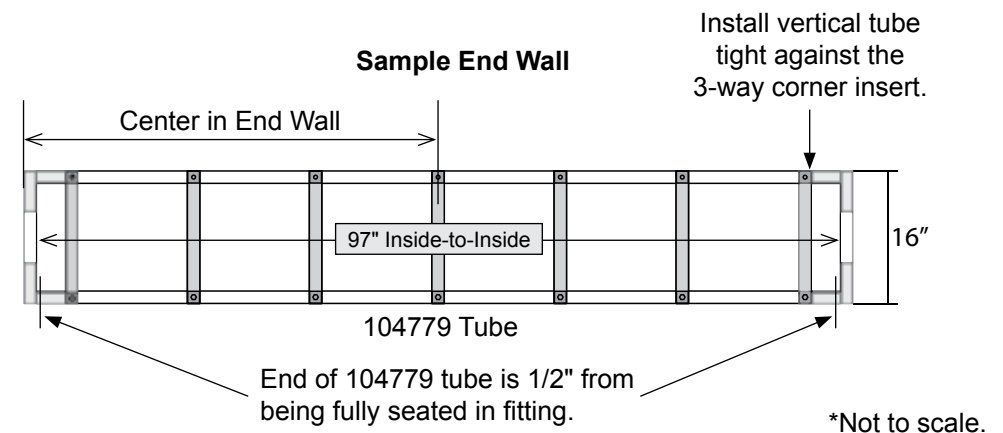


ASSEMBLY NOTE: During end frame assembly, set inside-to-inside dimension at 97". Do not seat tube tight to the inside of corner fitting. Doing so will result in a dimension too narrow to accept 96" lettuce rafts once liner is installed.

When setting inside dimensions always evenly divide space between couplers. At least 2" of any tube must remain within a coupler, fitting, or other tube.

Measure and set the 97" inside-to-inside width at each bottom cross brace throughout the length of raft bed frame.

Evenly space all beveled vertical frame supports. Secure to upper and lower frame members using FA4572 Tek screws.



5a

COLOR CODE: WHITE

ASSEMBLY NOTES

- Secure all tube and fitting connections using FA4572 Tek screws.
- Secure all upper and lower sidewall tube splices using a Tek screw installed through a fitting if splice is inside a fitting.
- Install Tek screws in positions that will not contact bed liner when installed.

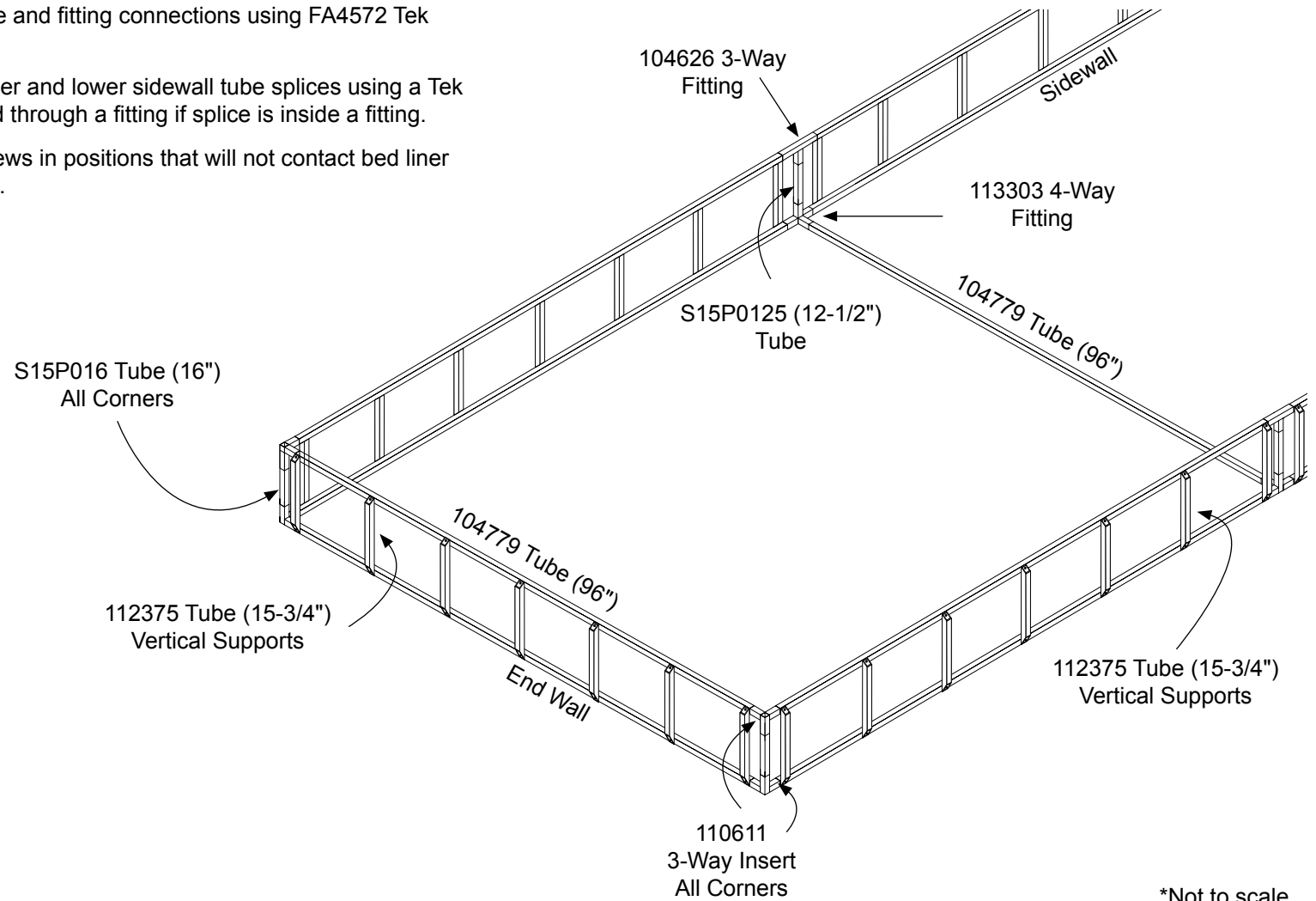


Diagram shows typical layout of square tube for upper and lower sidewall rails. Secure each tube splice using a Tek screw after frame is assembled. Install screws in locations that will not contact bed liner.

5a

ASSEMBLY STEPS

Use photos below and diagrams on previous pages to assemble one (1) 8' x 48'-8" raft bed frame.

Required parts:

- 110611 3-Way Corner Insert (8)
- S15P016 Square Tube @ 16" (4)
- 104779 Square Tube @ 96" (9)
- 102897 Square Tube @ 99" (24)
- S15P008 Square Tube @ 8" (4)
- 112375 Square Tube @ 15-3/4" w/ 45° Cuts (98)
- S15P0125 Square Tube @ 12-1/2" (10)
- 104626 3-Way T Fitting (10)
- 113303 4-Way Fitting (10)
- FA4572 Tek Screws
- 100442 Magnetic Nut Setter

ATTENTION: Do not install any Tek screw along top rail of raft bed frame. Surface is reserved for installation of raft bed liner and retaining bars.

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Above photo shows assembled cross supports installed and spaced on lower perimeter frame. Use diagrams on previous pages during assembly. Photos below show securing each frame tube to corner fittings using FA4572 Tek screws. Install vertical corner tubes flush to top of 3-way corner fitting. See circle in center photo below.



5a

ASSEMBLY STEPS – continued

During assembly and installation of all mid-frame supports, pull or push top of support *toward inside the frame*. Then install two Tek screws – one on each side of 4-way fitting – to secure fitting to cross brace. Off-set screw positions by 1"-2" to prevent creating a pivot point for cross brace.

COLOR CODE: WHITE



Dashed lines show location of each Tek screw—one installed through each side.



Arrow shows where to insert washers to tighten fitting and tube connection.

Install all Tek screws in locations that will not contact liner when installed.

ASSEMBLY NOTE: During assembly, insert flat washer(s) (FAMF13B) between 4-way fitting and 12-1/2" tube outside the frame to tighten connection. (Some connections may need two (2) washers.) Tap into place flush with top of fitting before installing Tek screw to secure connection. It is best to have the vertical frame tube tilted inward at the top. Weight of water when bed is filled will push outward on frame.

Grow-Out System: Raft Bed Assembly

5a

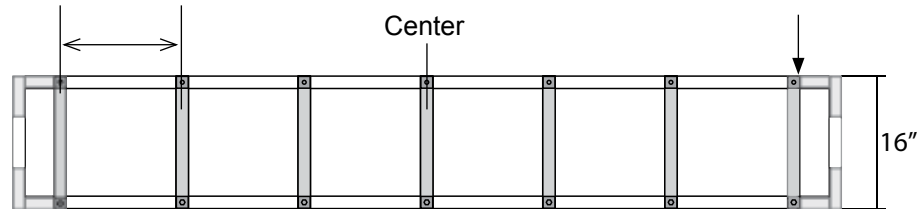
ASSEMBLY STEPS – continued

After perimeter frame is assembled, install all vertical supports. Secure each support using two (2) FA4572 Tek screws.

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Evenly space all verticals throughout length of raft bed frame.

Install vertical tube tight against 3-way corner and 3-way tee fittings.



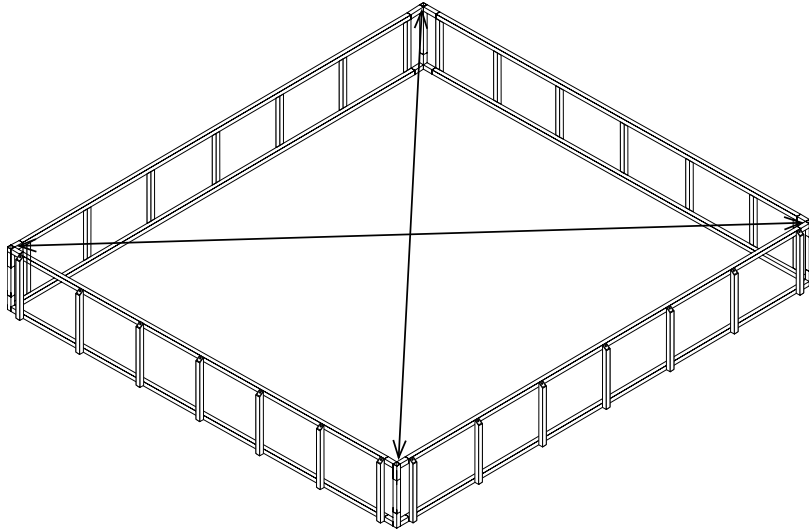
5b

SQUARE ASSEMBLED RAFT BED FRAME

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ATTENTION: Actual frame may differ from what is shown. Procedure to square frame is the same.

After assembly, check all connections to verify that Tek screws are properly installed. Next, measure corner-to-corner diagonally as shown. When dimensions are the same, frame is square. Finally, level frame. **Frame must be level so water depth is consistent throughout frame once raft bed is filled.** Prepare site inside frame if not on a solid surface such as wood or concrete.



Grow-Out System: Insulate Raft Bed Frame

5c

INSULATE RAFT BED FRAME

Complete these steps:

1. Once frame is level, insulate frame bottom. (Frame shown below may differ from actual frame.) **NOTE:** Frame sides can be insulated first (or from the outside) if desired to prevent damage to bottom insulation.



2. Cut insulation board as needed to fit side and end walls.

ATTENTION: If you purchased a heating package, install those components according to instructions sent with the heat package. Then continue with **Section 5d** of this guide. **You must install the Tekfoil and heat tubing included with heat package (if purchased) before you install bed liner.**

If no heat package was purchased, continue with Section 5d.

COLOR CODE: RED



Water Temperature: Heating Raft Beds



HEATING RAFT BEDS

In-bed heat systems are typically installed to help maintain a constant water temperature to optimize fish and plant growth. Depending on conditions and fish species raised, some systems may benefit from (or require) heated raft beds. **A raft bed heat system is not part of this aquaponic system.**

Consult the services of a qualified contractor familiar with installing similar heating systems. If you purchased components to heat your aquaponic system, install tubing in raft bed *before* liner installation. See note above.

After installing raft bed tubing for heat (if needed), return to these instructions and continue with **Section 5d** to install raft bed liner.

ATTENTION: Regardless of raft bed size, follow these general guidelines:

- Maximum length of any tube loop should not exceed 300';
- Loops must be of equal length.

*Actual raft bed and number of lines may differ from examples shown. Some systems may not need a heat package.



Grow-Out System: Raft Bed Liner Installation

5d

INSTALL RAFT BED LINER

Once liner bed is prepared, continue with installation of liner. Assistants are required.

Required parts:

- 113390Z052 Raft Bed Liner
- FA4572 Tek Screws, 102921B Washers, and 100442 Nut Setter

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ATTENTION: During liner installation, do not drop any tools or sharp objects into liner bed. Doing so can puncture liner! Exercise caution!

Verify that all debris is removed from insulation surface that could damage or puncture liner once installed.



1. With assistance, carefully spread liner over assembled frame. Ensure that equal lengths overhang ends and sides.



2. Beginning at one corner, loosely and carefully fold and press liner into corner and along inside of base rails.



3. Fold liner evenly up and over top of frame rails. Remove as many wrinkles as possible. **Do not crease liner material.**



4. Take two (2) FA4572 Tek screws and two (2) 102921B neo-bonded washers and carefully secure liner to top of frame.



NOTE: Ensure liner is fully seated in corners and on bottom. Remove fasteners after entire liner is in position.



5. Move to another corner and press liner into place.

ATTENTION: During liner installation liner, do not drop any tools or sharp objects into ben liner. Doing so can puncture the liner! Exercise caution!



6. Cut material as needed to allow it to fit more evenly at corners. *Do not drop any sharp objects into bed liner at any time.* Contact your sales representative for products used to repair damage to liner if needed. Repeat steps to secure liner material.
7. Check bottom of liner for wrinkles and remove these by working material toward free edge. *Once liner is fully secured as described on next pages, there should be no tension on fasteners.*
8. Move to remaining corners and repeat steps to temporarily secure them to frame.



NOTE: Some photos show water in raft beds. Water is added after the NFT frame and channels (Section 14) are added.

9. Check entire liner to ensure it is seated on bottom and against all corners and edges.
10. Remove excess material that touches ground. Allow 8"-10" to remain for final steps. *Extra material is trimmed later.*
11. Complete steps to prepare and install pre-drilled aluminum retaining strap.

5d

SECURE LINER TO FRAME

COLOR CODE: WHITE

Attach 110155 aluminum flat stock to frame using FA4572 Tek screws and 100442 driver.



1. Begin at a corner and remove Tek screw and washer to install first piece of 110155 .



2. Align aluminum with frame fitting and attach using the FA4572 Tek screw.



NOTE: Take the necessary steps prevent metal shavings from dropping into raft bed.



3. Continue attaching sections of 110155 to the frame until entire perimeter of bed liner is secure.
4. Using a utility knife or scissors, remove excess bed liner material. Allow 1/2" or so to remain beyond the edge of strap if desired.



5. Repeat Section 5 to install remaining raft bed liner.
6. After installing both raft bed liners continue with Section 6.

NOTE: Some photos show water in raft beds. Water is added after the NFT frame and channels (Section 14) are added.

Aeration Manifolds: Grow-Out System

6

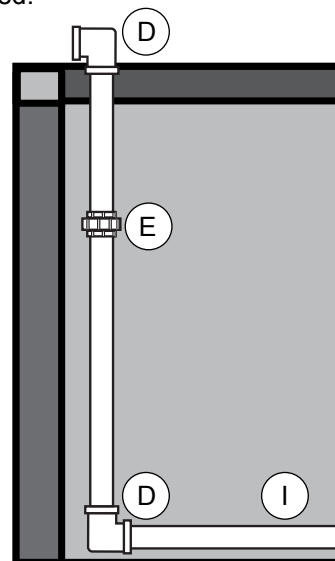
AERATION SYSTEM ASSEMBLY AND INSTALLATION – GROW-OUT SYSTEM 8' x 48'-8" RAFT BEDS

Assemble in-bed supply lines as shown *before installing the NFT frames*. These parts are included for aeration system plumbing for one raft bed:

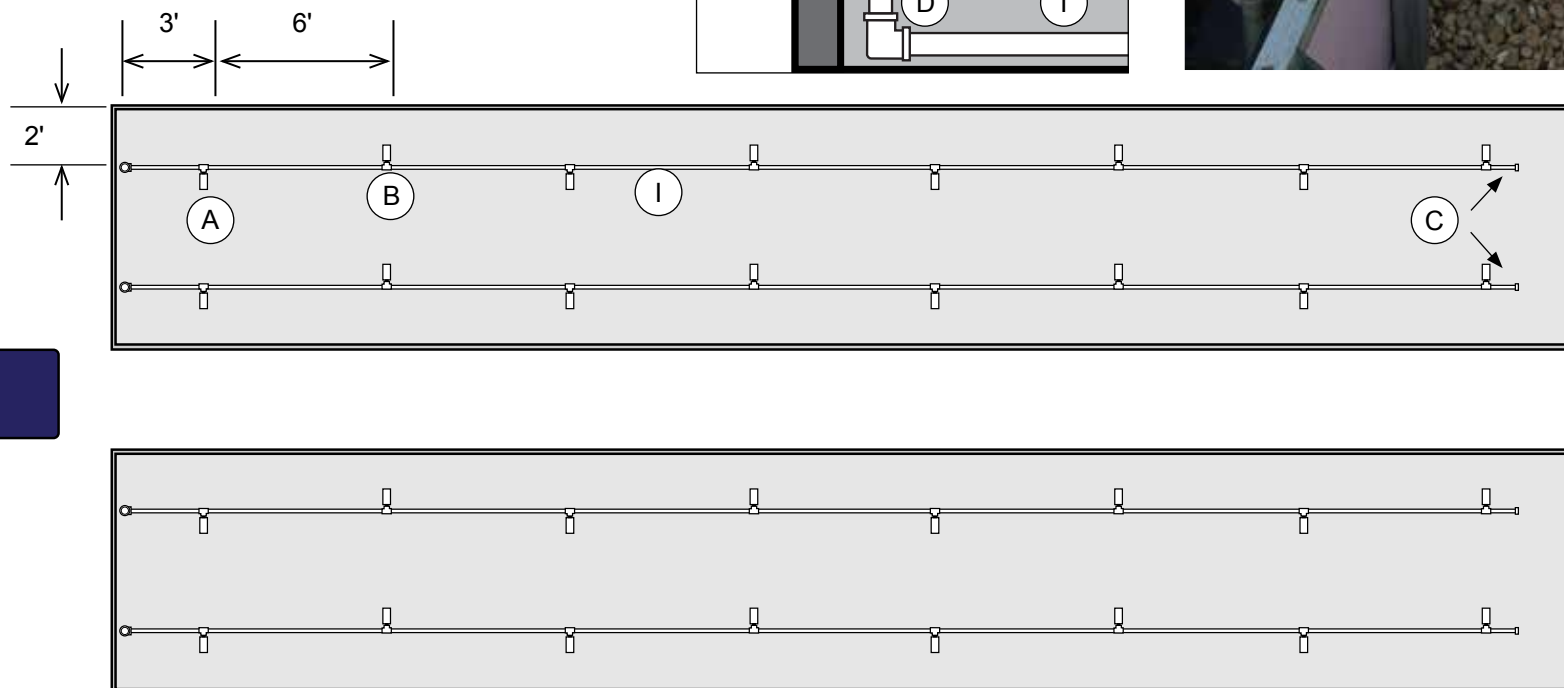
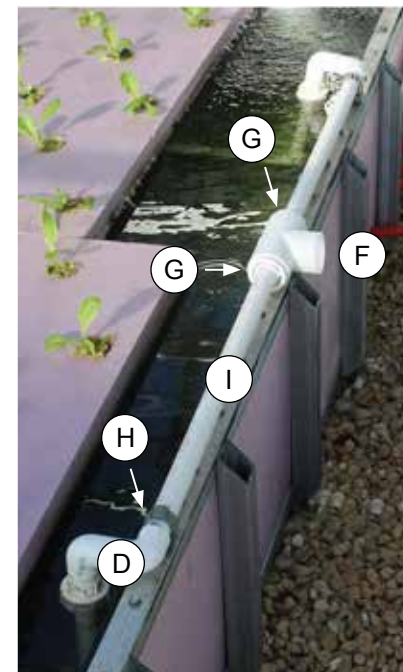
- (16) AQ113 6" Airstone 1/2" NPT (A)
- (16) WF1355 (3/4" Slip x 3/4" Slip x 1/2" FPT) Tee (B)
- (2) WF2990 (3/4") End Cap (C)
- (6) WF1530 (3/4") 90° Elbow (D)
- (2) WF3410 (3/4") Slip x Slip Union (E)
- (1) WF1384 1-1/2" (Slip x Slip x Slip) Tee (F)
- (2) WF6665 1-1/2" to 3/4" Reducer Bushing (G)
- 106808 3/4" Pipe Hanger and FA4572 Tek Screws (H)
- WF4130 3/4" PVC (I)

Side View — End

Vertical air pipe to connect to main supply line from air pump. Attach when all aeration components are installed.



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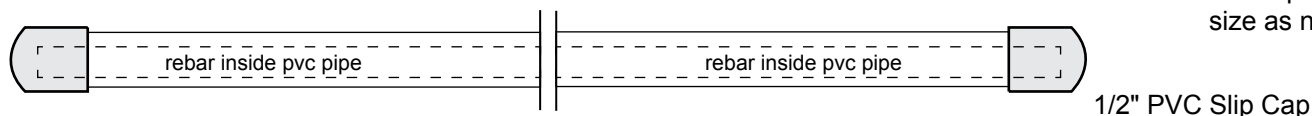
6

AERATION SYSTEM ASSEMBLY AND INSTALLATION – GROW-OUT SYSTEM RAFT BEDS — CUSTOMER-SUPPLIED AIR MANIFOLD WEIGHTS (continued)

The air supply manifold in each raft bed is buoyant, especially when air pump is operating. To keep manifold firmly in place at bottom of each raft bed during operation, construct water-tight weights (using customer-supplied materials) and attach to each manifold throughout their lengths. Here is one suggestion for constructing customer-supplied air manifold weights. See suggested customer-supplied materials list at the right.

Complete these steps:

1. Take a 10' stick of 1/2" pvc pipe and slide a 10' length of 1/2" rebar inside it.
2. Using pvc primer, glue, and 1/2" pvc end caps, seal rebar inside pvc pipe. Allow to dry.



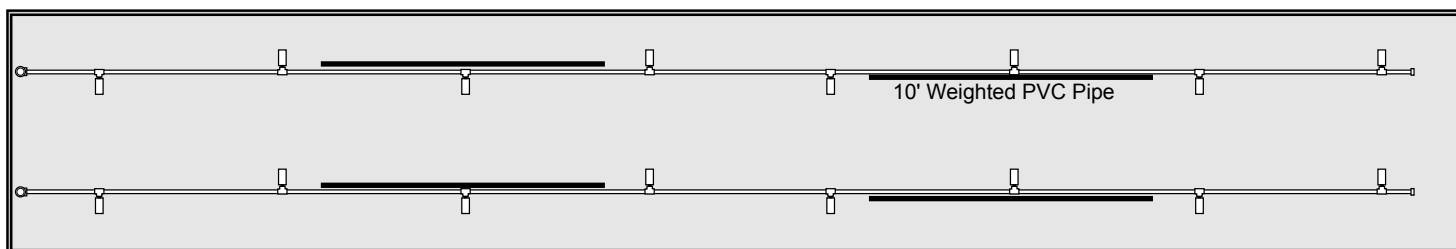
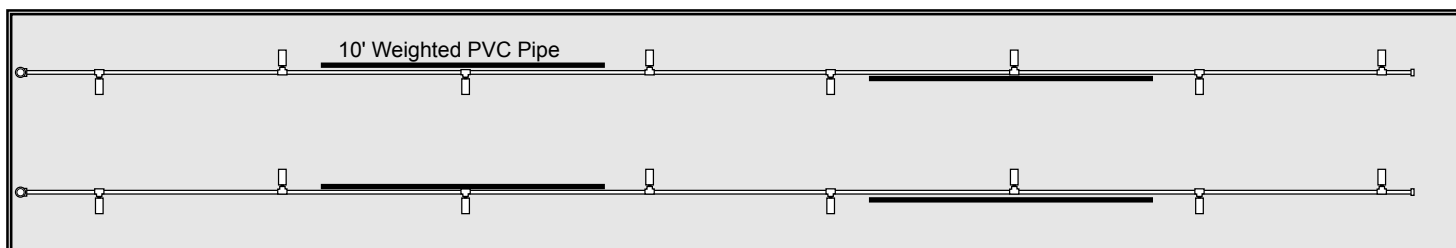
3. Carefully place weight along one air manifold between air stones, or on top of center tube.
4. Secure weight to manifold using a few plastic zip ties.
5. Repeat to create additional weights as needed. Use two (2) 10' weights for each center tube of each manifold.

CUSTOMER-SUPPLIED MATERIALS

Suggested parts to construct *customer-supplied weights* for raft bed air manifolds:

- 1/2" PVC Pipe in 10' Lengths
- 1/2" PVC Slip Caps
- 1/2" reinforcing bar (rebar)
- Plastic Zip Ties
- PVC Primer and Glue to seal tubes.

ATTENTION: When purchasing rebar and pvc to construct weights, check that rebar actually fits inside pvc pipe *before purchasing*. Increase pvc size as needed to allow 1/2" rebar to fit inside.



Supply Plumbing and Pump Stations



The sections that follow describe assembling the different pump stations and supply lines for this commercial aquaponic system. Grow-out system has one (1) pump station for each raft bed as shown in Section 7. Fingerling system has a single pump station for media bed as shown in Section 8. These pump stations can be assembled simultaneously and independent of each other. Use the photos on this page for reference when completing Sections 7 and 8.

SECTION 7: Grow-Out System — Raft Bed Pump Station & Supply & Drain Lines

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NOTE: Examples show buried outlet supply lines from pump to tanks. Diagrams throughout this guide display these lines running along raft beds and above finished grade of building.

SECTION 8: Fingerling System — Media Bed Pump Station & Supply & Drain Lines

COLOR CODE: BLUE & RED



Grow-Out: Raft Bed Pump & Supply & Drain

7

PUMP STATIONS FOR RAFT BEDS

There are two (2) pump stations—one for each raft bed. Use diagrams below to assemble and install pump stations. Before assembly, coat all slip and pipe connections with pvc primer and pvc glue according to instructions on primer and cement container.

IMPORTANT: To save time and materials, *dry fit all assemblies and check fit before final assembly!*

Steps and parts list on this page show assembly of a single pump station. Repeat to assemble the second. **Be conscious of pump position and fitting orientation during final assembly.**

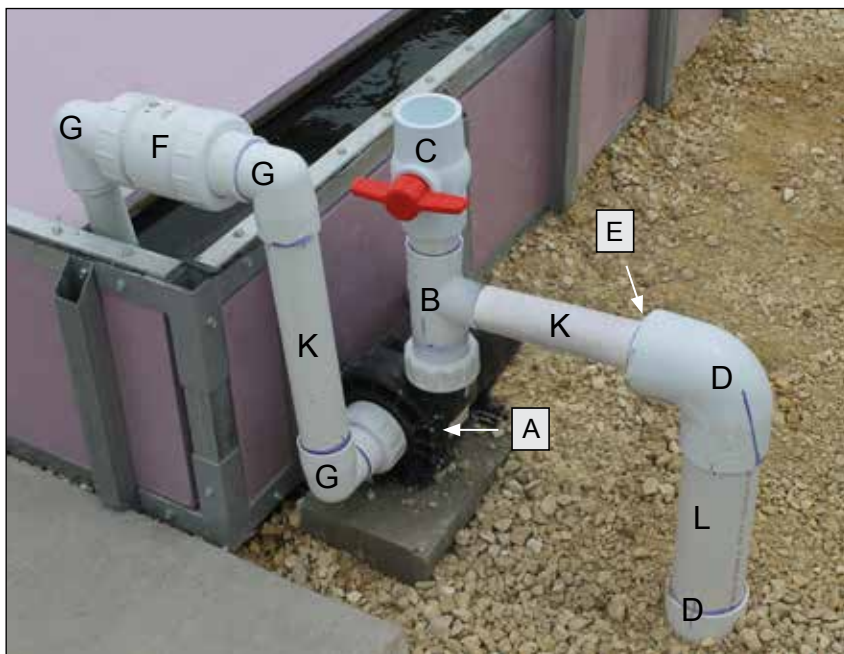
Refer to cover page diagram and Section 1 for recommended layout.

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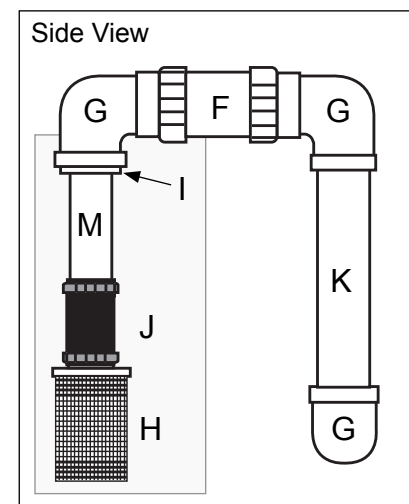
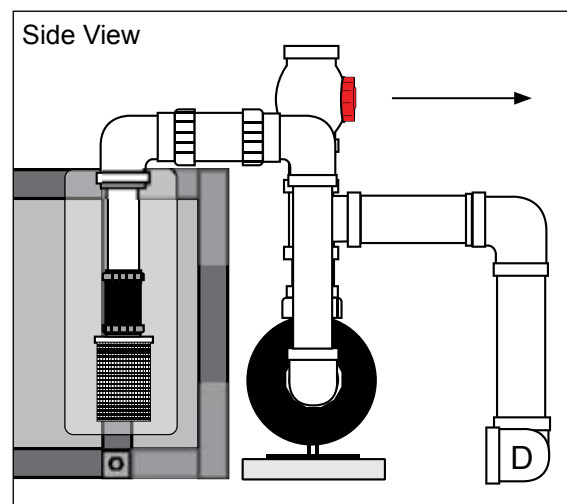
Parts for each pump station:

- (1) 111148 1/3 HP Dolphin Pump (A)
- (1) WF1386 2" Tee (B)
- (1) WF3516 2" Ball Valve (C)
- (3) WF0016 3" 90° Elbow (D)
- (1) WF0015 (2" x 3") Bushing (E)
- (1) 111153 2" Check Valve (F)
- (3) WF6685 2" 90° Elbow (Slip x Spigot) (G)
- (1) 111154 1-1/2" Basket Strainer (H)
- (1) WF6671 (2" x 1-1/2") Bushing (I)
- (1) WF0014 1-1/2" Fernco® Fitting (J)
- 2" PVC Pipe (cut to length) (K)
- 3" PVC Pipe (cut to length) (L)
- 1-1/2" PVC Pipe (cut to length) (M)
- 113372 PVC Primer and WR6990 PVC Cement

Pump Station for Single Raft Bed



ATTENTION: Shaded area identifies those parts that are inside raft bed.



7a

SUPPLY LINES TO 1,200 GALLON TANKS

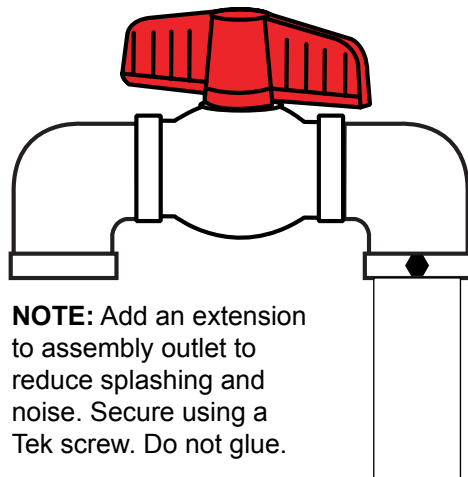
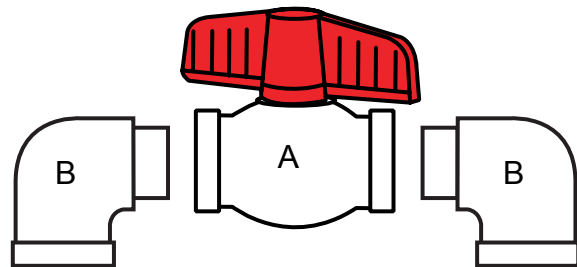
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Parts for each supply pipe control valve:

- (1) WF3516 2" Ball Valve (A)
- (2) WF6685 2" 90° Elbow (Slip x Spigot) (B)
- 113372 PVC Primer and WF6990 PVC Cement

Complete these steps to construct the supply line from pump station to 1,200 tanks.

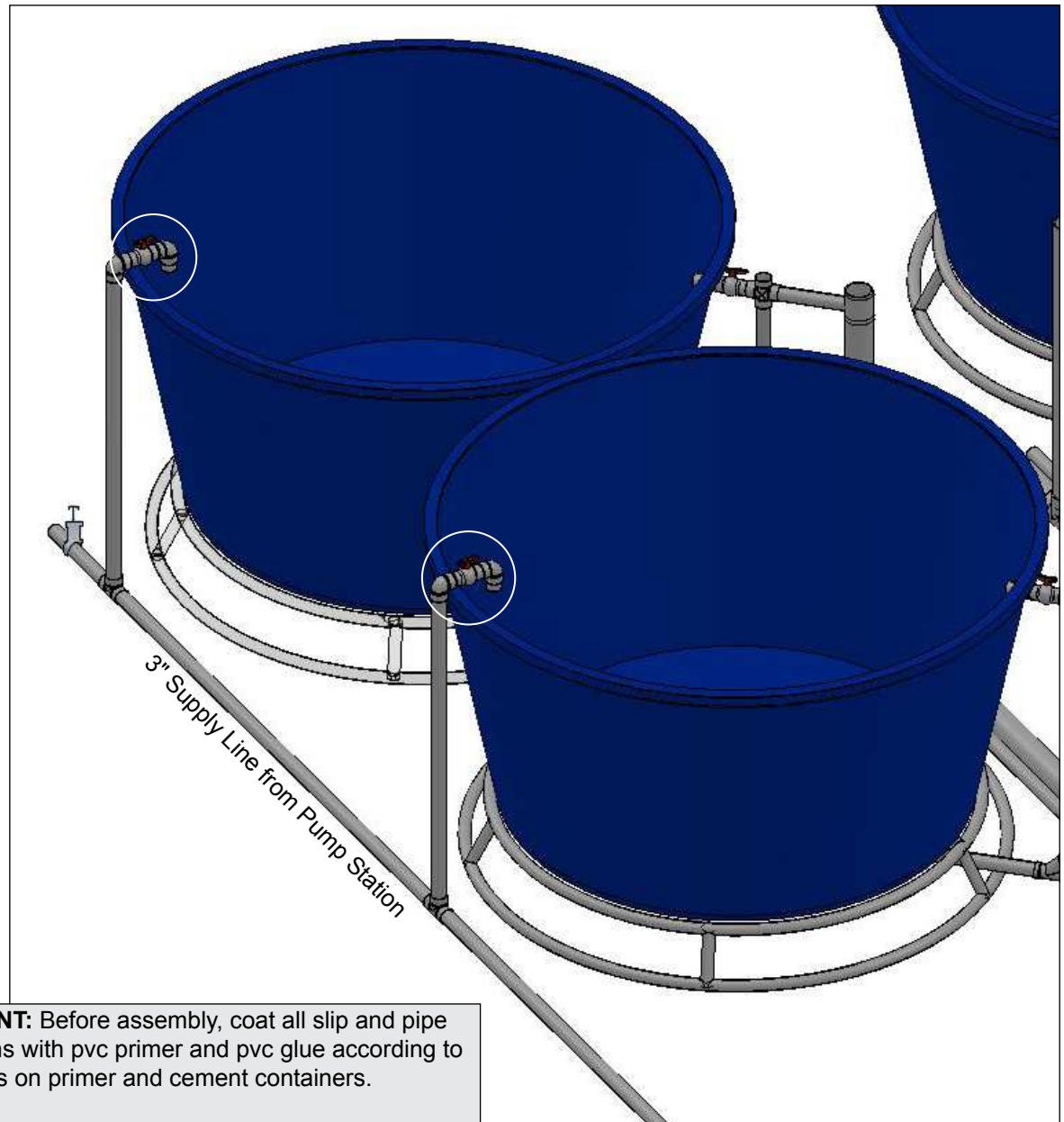
1. Locate the parts noted above and assemble the control valve for each supply pipe. There is one assembly for each 1,200 gallon tank.



NOTE: Add an extension to assembly outlet to reduce splashing and noise. Secure using a Tek screw. Do not glue.

IMPORTANT: Before assembly, coat all slip and pipe connections with pvc primer and pvc glue according to instructions on primer and cement containers.

To minimize mistakes, **dry fit all assemblies and check fit before final assembly using glue!**

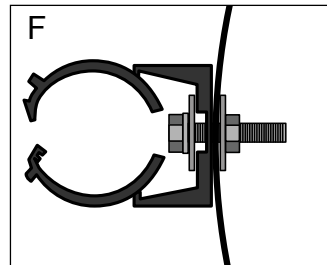


7a

SUPPLY LINES TO 1,200 GALLON TANKS – continued

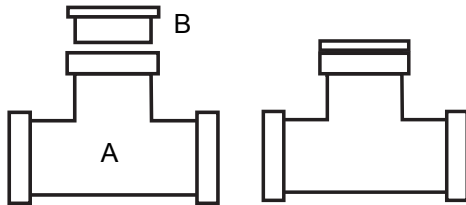
Parts for each main supply line from pump station to tank supply standpipes:

- (2) WF0017 3" Tee Fittings (A)
- (2) WF0015 (2" x 3") Bushing (B)
- (1) WF3327 3" Gate Valve (C)
- 3" PVC Pipe (D)
- 2" PVC Pipe (E)
- (1) FAG104B (1/4" x 1") Hex Bolt (F)
- (2) FAMF11B (1/4") Fender Washer (F)
- (1) FALF15B (1/4") Locknut (F)
- (1) 112539 Pipe Hanger (F)



112539 Pipe Hanger– One per tank.

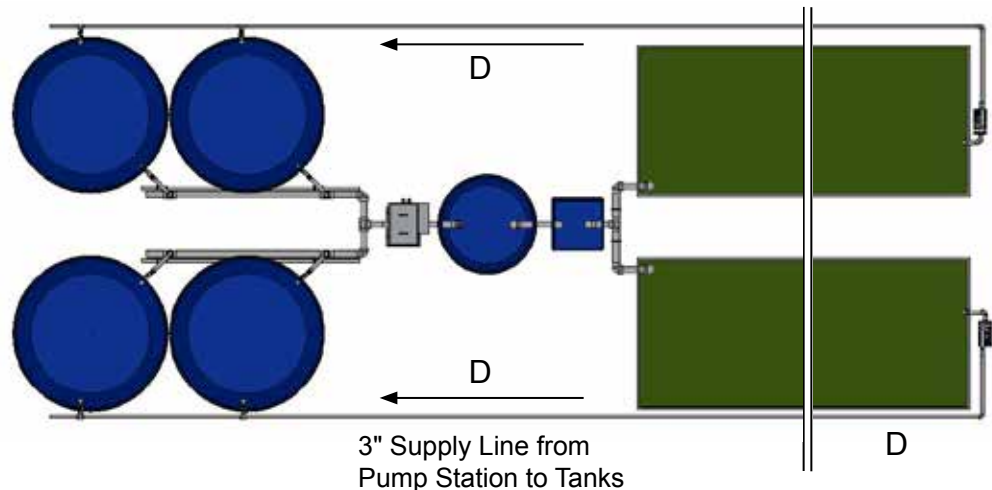
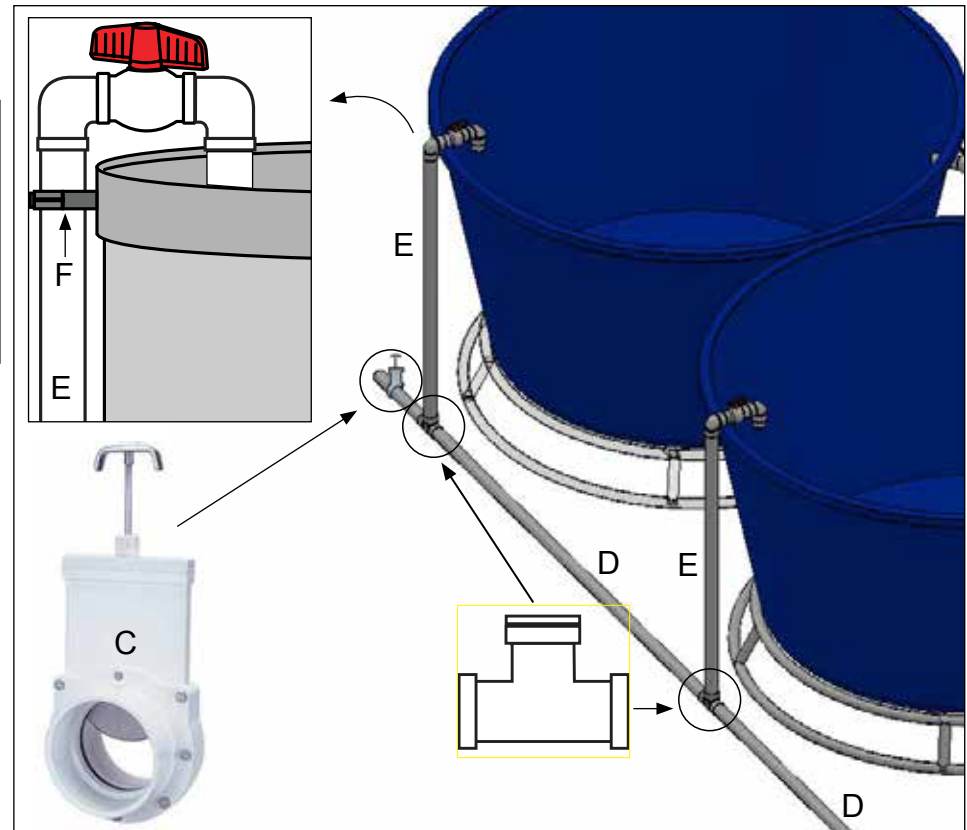
2. Gather pvc parts noted above and construct tee fittings as shown. There is one assembly for each 1,200 gallon tank.



3. Using 2" pvc pipe for vertical supply tubes and 3" pvc pipe for main pipe from pump station to tanks, connect assemblies to construct supply plumbing as shown. Use 3" couplers (WF0018) as needed to connect 3" pvc pipes.

NOTE: Cut 2" vertical pipe so control valve assembly is 2" to 3" above tank top.

4. Secure each vertical tube to tank using a clamp and 1/4" fasteners noted above. Drill a 5/16" hole in tank lip to attach clamp and supply pipe. See Diagram F above.
5. Install gate valve at end of each 3" supply line. Close valve.



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7b

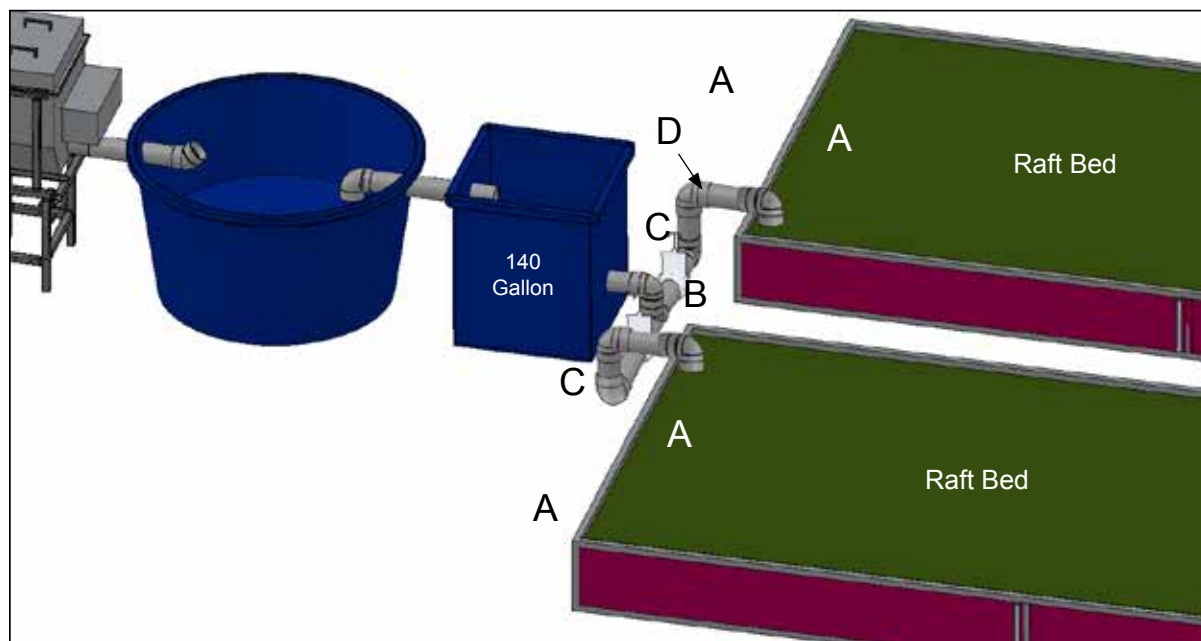
DRAIN LINES TO RAFT BEDS



Before completing this section, assemble raft beds to better judge length of 4" pvc pipe that is needed. Increasing distance between 140 gallon sump and raft beds may require purchase of additional 4" pvc and fittings. Measure remaining 4" tubing and position rafts accordingly (if possible). Connect 4" fittings using short sections of 4" pvc pipe.

Complete these steps:

1. Use fittings noted on this page and assemble the 4" drain tubing for raft beds.



2. After pipe and fittings are glued, drill a 1/4" hole in the top of 90° elbow at bend as shown to prevent siphoning.

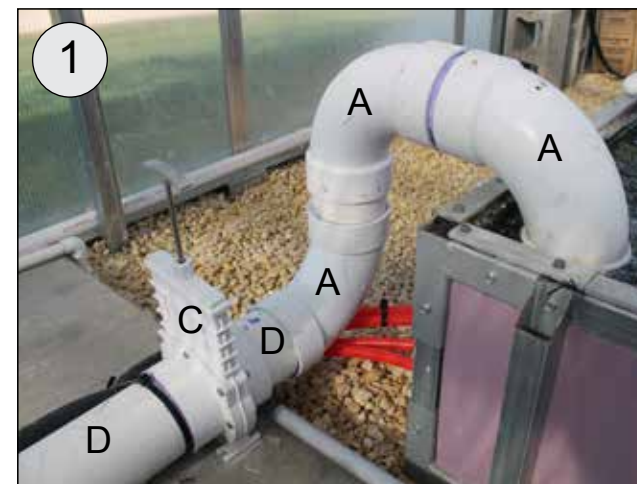
IMPORTANT: Before assembly, coat all slip connections with pvc primer and pvc glue according to instructions on primer and cement container.

To minimize mistakes, **dry fit all assemblies and check fit before final assembly!**

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Parts for drain line to raft beds:

- (9) WF0007 4" 90° Elbow (A)
- (1) WF0008 4" Tee (Slip x Slip x Slip) (B)
- (2) WF3330 4" Gate Valve (C)
- WF4171 4" PVC Pipe (D)
- PVC Primer and PVC Cement



ATTENTION: Position gate valves anywhere after tee fitting to allow isolation of one or both raft beds. Photo above shows installation close to elbows; diagram shows valve closer to 4" tee fitting. Connect all 90° elbows using short sections of 4" pvc tubing.



Fingerling System: Pump Station & Supply & 4" Drain Lines

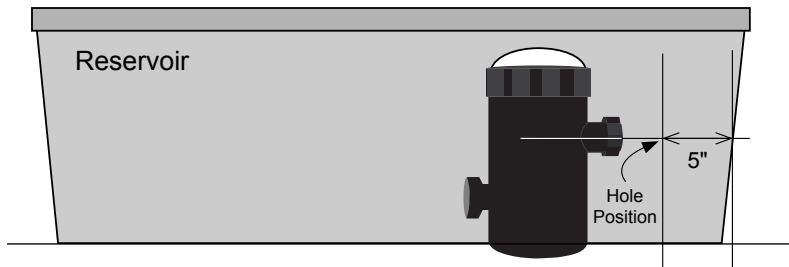
8

PREPARE 115 GALLON RESERVOIR AND INSTALL 2" BULKHEAD FITTING

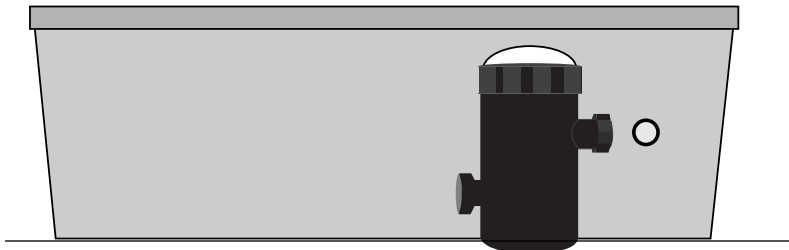
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Use photos and diagrams to assemble media bed pump station and prepare media bed reservoir.

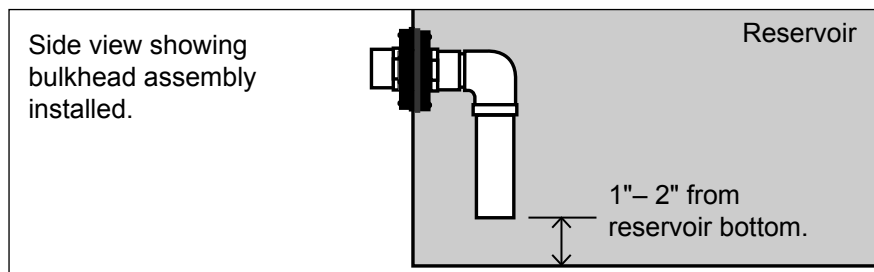
1. Set reservoir and strainer on flat surface and mark bulkhead position on reservoir using upper inlet port on strainer as guide. Hole position is approximately 5" from edge of tank to allow room for bulkhead fitting.



2. Drill 3" hole for bulkhead and clean edges of hole using fine grit sandpaper.



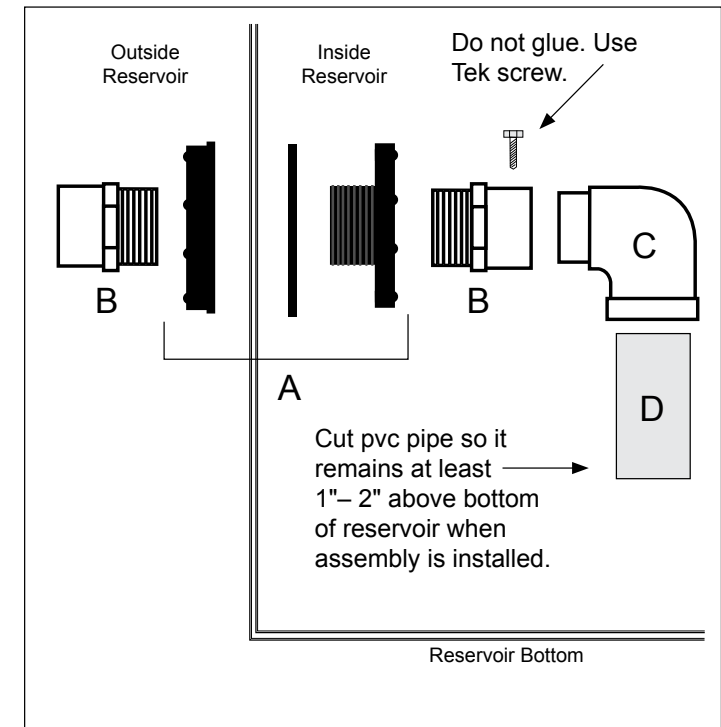
3. Take 2" bulkhead fitting and attach the WF2199 adapters. Refer to bulkhead fitting install steps presented earlier in this guide if needed.
4. Insert assembly into reservoir and tighten. Position rubber seal inside and locking nut outside reservoir. See exploded view of assembly at right.



5. Continue with fingerling pump station assembly.

Parts for reservoir bulkhead assembly:

- (1) 112966 2" Bulkhead Fitting (A)
- (2) WF2199 2" M x S Adapter (B)
- (1) WF6685 2" 90° Elbow (Slip x Spigot) (C)
- 2" Section of PVC Pipe (D)
- PVC Primer and PVC Cement



8a

ASSEMBLE MEDIA BED PUMP STATION

Construct pump station assembly:

1. Place reservoir under media bed at end where pump station will be located. Align porthole in reservoir lid with media bed drain.

ATTENTION: PVC elbows (circled in left photo) are included (if needed) to better align media bed drain with reservoir and to keep reservoir positioned under media bed frame.

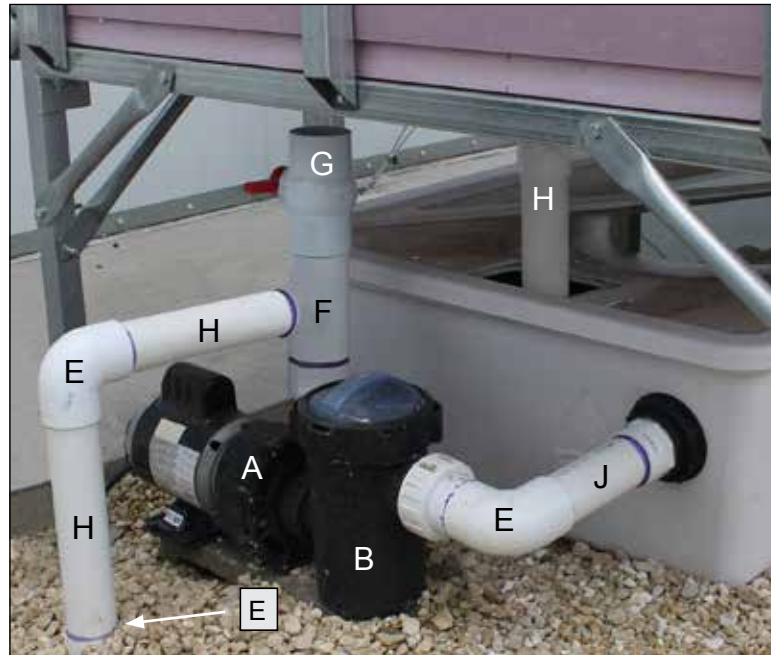
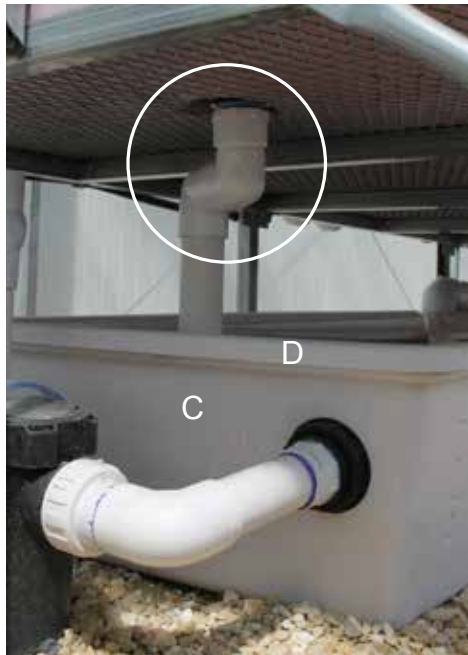


Photo (right) shows supply line from pump buried in gravel bed of greenhouse. (See arrow above.)
Diagram (next page) shows supply line running on top of finished greenhouse floor. Position depends on desired result and overall layout.

2. Using parts in component list, assemble the pump station as shown.
3. Continue by installing supply lines to tanks.

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Parts needed for pump station and reservoir:

- (1) 111148 1/3 HP Dolphin Pump (A)
- (1) 111152 Primer/Strainer (B)
- (1) 113801 115 Gallon Reservoir (C)
- (1) 113802 115 Gallon Lid (D)
- (3) WF1576 2" 90° Elbow (E)
- (1) WF1386 2" Tee (F)
- (1) WF3516 2" Ball Valve (G)
- 2" PVC Pipe (cut to length) (H)
- PVC Primer and PVC Cement

IMPORTANT: Before assembly, coat all slip and pipe connections with pvc primer and pvc glue according to instructions on primer and cement containers.

To minimize mistakes, **dry fit all assemblies and check fit before final assembly!**

8b

ASSEMBLE AND INSTALL SUPPLY LINES TO 50 AND 250 GALLON TANKS

The fingerling system as shown includes a main supply line that runs from pump station to the 50 and 250 gallon tanks. After pump station is complete, install the 2" pvc supply lines and related fittings and valves.

Diagram shows supply line running at ground level from pump. Photo on next page shows supply line attached to building wall.

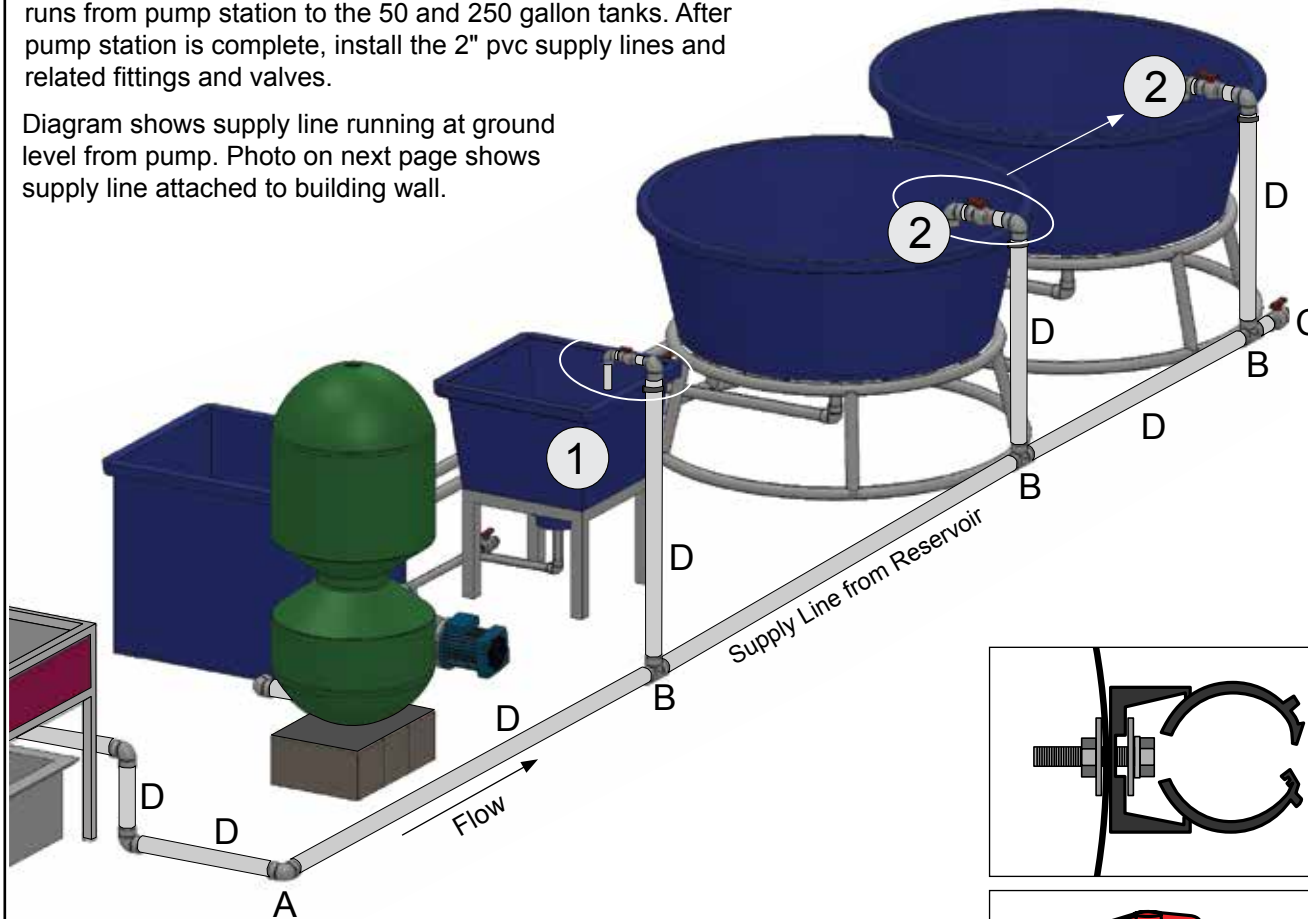
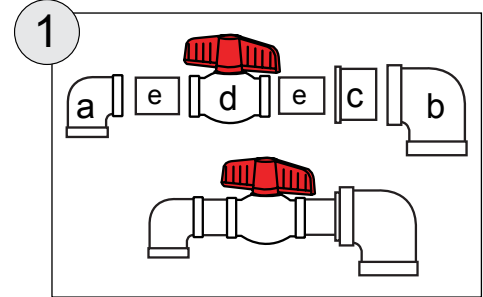


Diagram a: Parts to secure vertical supply lines from pump station to tanks:

- (1) FAG104B (1/4" x 1") Hex Bolt
- (2) FAMF11B (1/4") Fender Washer
- (1) FALF15B (1/4") Locknut
- (1) 112539 Pipe Hanger

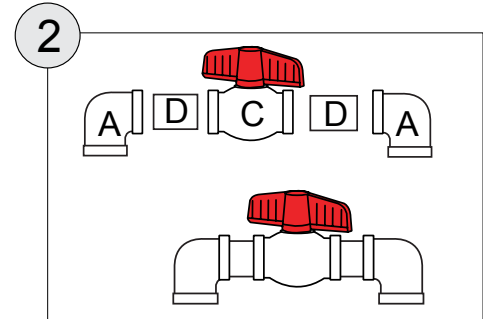
ATTENTION: To reduce noise and splashing, add an extension pipe to outlet of valve assemblies (1 & 2). Do not glue pipe to assembly; secure each using a Tek screw.

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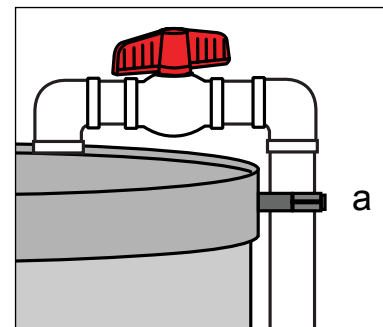
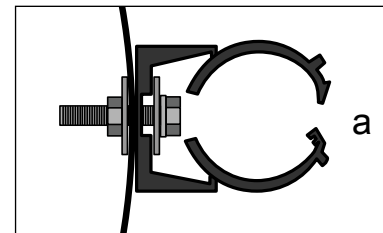
Parts for 50 gallon tank 1" valve assembly:

- (1) WF1570 1" 90° Elbow (a)
- (1) WF1576 2" 90° Elbow (b)
- (1) WF0023 2" x 1" Bushing (c)
- (1) WF3316 1" Ball Valve (d)
- 1" PVC Pipe (cut to length) (e)
- PVC Primer and PVC Cement



Parts for supply line (on floor) and 250 gallon tank 2" valve assembly:

- (5) WF1576 2" 90° Elbow (A)
- (3) WF1386 2" Tee (B)
- (2) WF3516 2" Ball Valve (C)
- 2" PVC Pipe (cut to length) (D)
- PVC Primer and PVC Cement



Supply Line Attached to Wall: Photo below shows a sample fingerling system with supply line attached to and running along building wall. If using this setup, attach a customer-supplied stringer board to building wall. Next, secure 2" clamps every 48" to stringer board using customer-supplied wood screws.



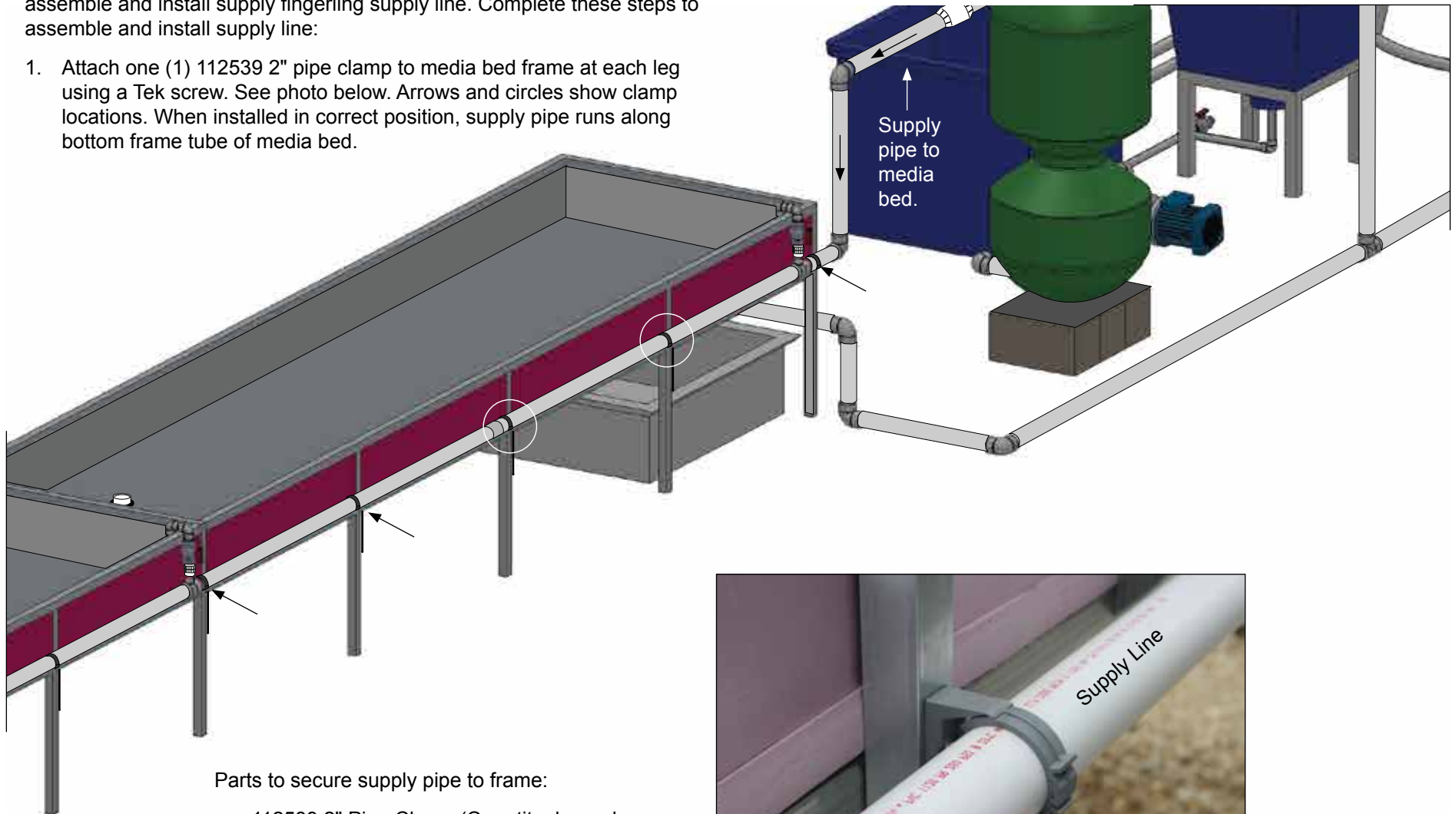


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ASSEMBLE AND INSTALL SUPPLY LINE FROM BEAD FILTER TO MEDIA BED

Supply line runs from bead filter to media bed. Use these diagrams to assemble and install supply fingerling supply line. Complete these steps to assemble and install supply line:

1. Attach one (1) 112539 2" pipe clamp to media bed frame at each leg using a Tek screw. See photo below. Arrows and circles show clamp locations. When installed in correct position, supply pipe runs along bottom frame tube of media bed.



Parts to secure supply pipe to frame:

- 112539 2" Pipe Clamp (Quantity depends on length of media bed.)
- FA4572B Tek Screw (Use one per pipe clamp.)



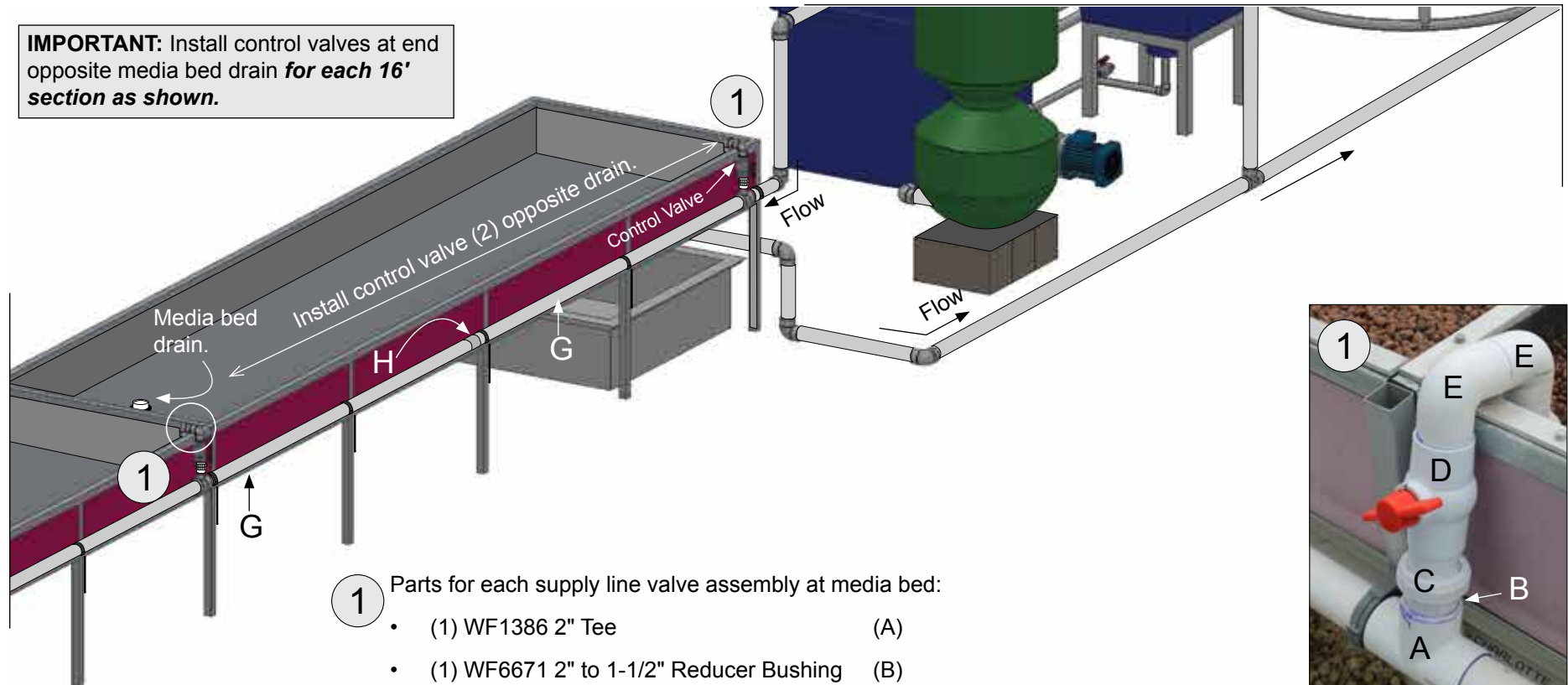


ASSEMBLE AND INSTALL SUPPLY LINE FROM BEAD FILTER TO MEDIA BED – continued

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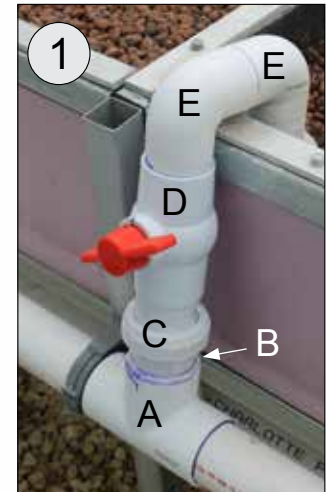
2. Assemble control valves using diagrams and parts shown on this page.

IMPORTANT: Install control valves at end opposite media bed drain *for each 16' section as shown.*



1 Parts for each supply line valve assembly at media bed:

- (1) WF1386 2" Tee (A)
- (1) WF6671 2" to 1-1/2" Reducer Bushing (B)
- (1) 112285 1-1/2" Union (C)
- (1) WF3511 1-1/2" Ball Valve (D)
- (2) WF1574 Slip x Slip 90° Elbow (1-1/2") (E)
- (1) 112366 1-1/2" 45° Slip x Street Elbow (F)
- 2" PVC Pipe (G)
- WF1984 2" Coupling (use when needed) (H)
- 1-1/2" PVC Pipe (cut to length as needed)



IMPORTANT: Before assembly, coat all slip and pipe connections with pvc primer and pvc glue according to instructions on primer and cement containers.

To minimize mistakes, **dry fit all assemblies and check fit before final assembly using glue!**

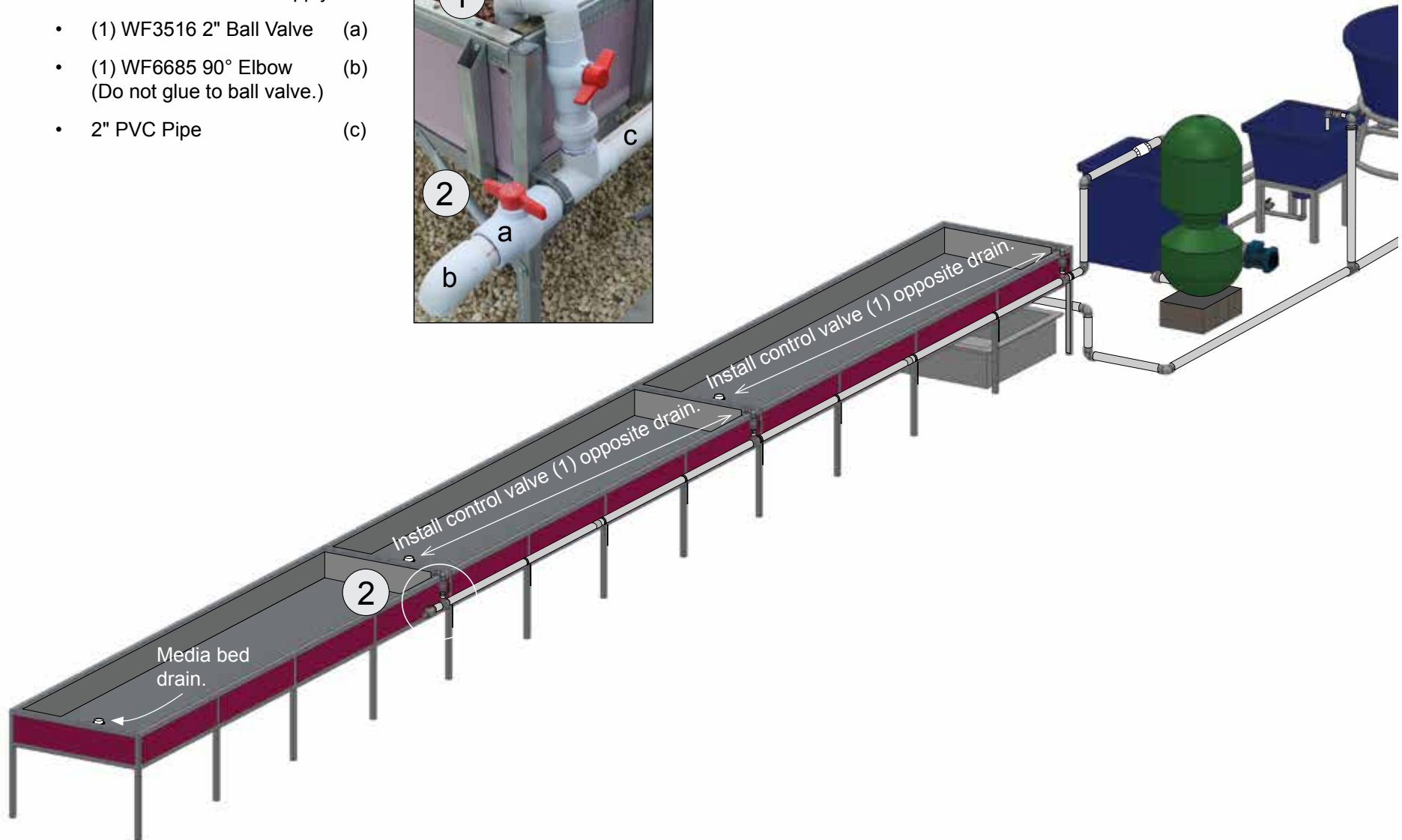
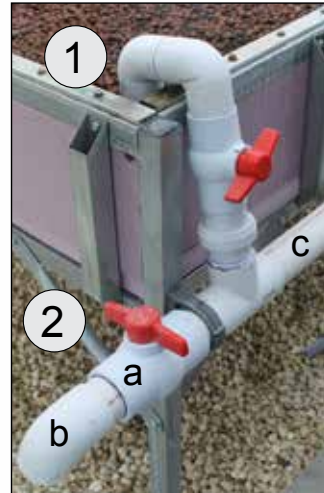


ASSEMBLE AND INSTALL SUPPLY LINE FROM BEAD FILTER TO MEDIA BED – continued

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2 Parts for valve at end of supply line:

- (1) WF3516 2" Ball Valve (a)
- (1) WF6685 90° Elbow (Do not glue to ball valve.) (b)
- 2" PVC Pipe (c)



8d

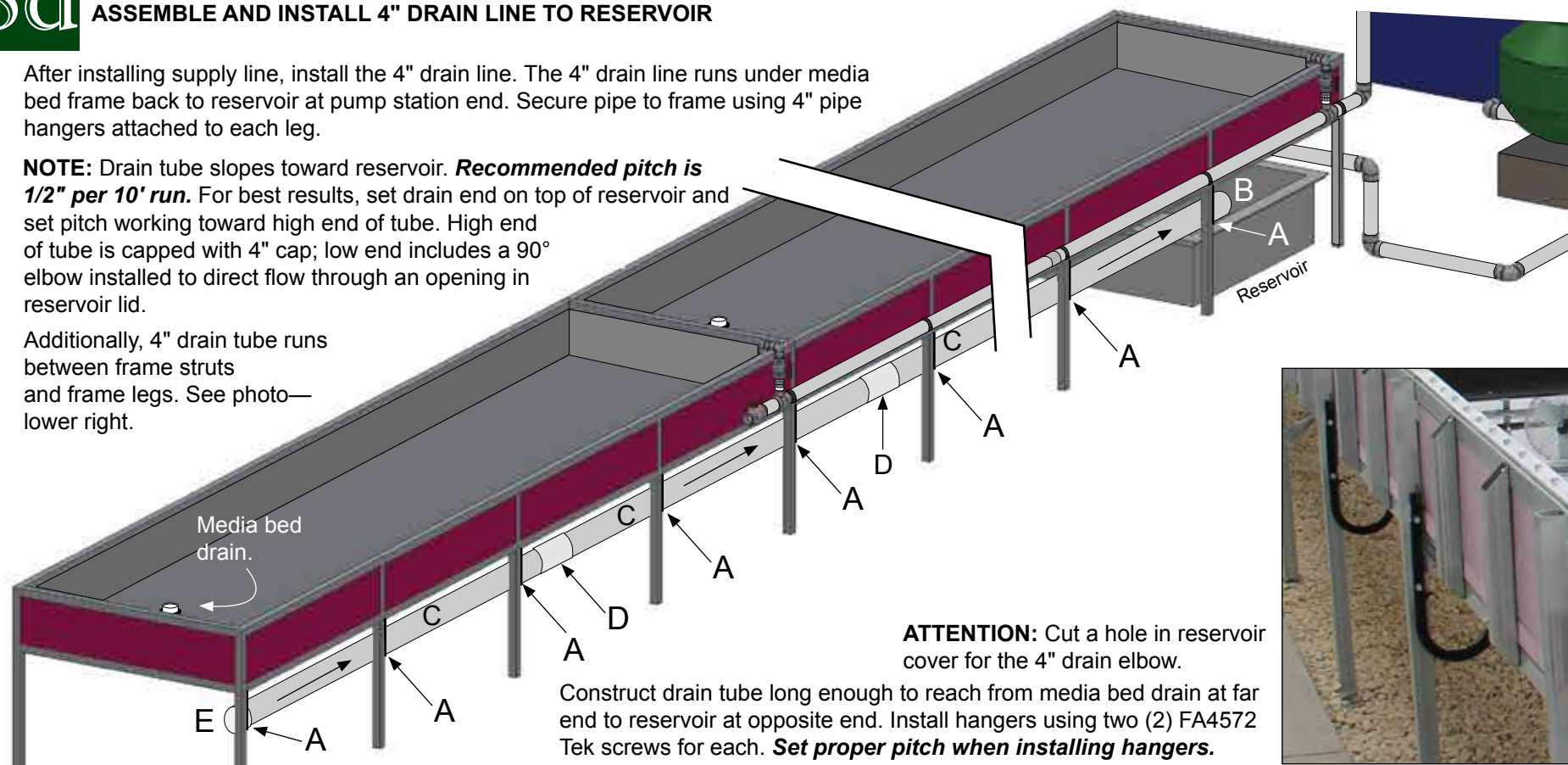
ASSEMBLE AND INSTALL 4" DRAIN LINE TO RESERVOIR

- After installing supply line, install the 4" drain line. The 4" drain line runs under media bed frame back to reservoir at pump station end. Secure pipe to frame using 4" pipe hangers attached to each leg.

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NOTE: Drain tube slopes toward reservoir. **Recommended pitch is 1/2" per 10' run.** For best results, set drain end on top of reservoir and set pitch working toward high end of tube. High end of tube is capped with 4" cap; low end includes a 90° elbow installed to direct flow through an opening in reservoir lid.

Additionally, 4" drain tube runs between frame struts and frame legs. See photo—lower right.

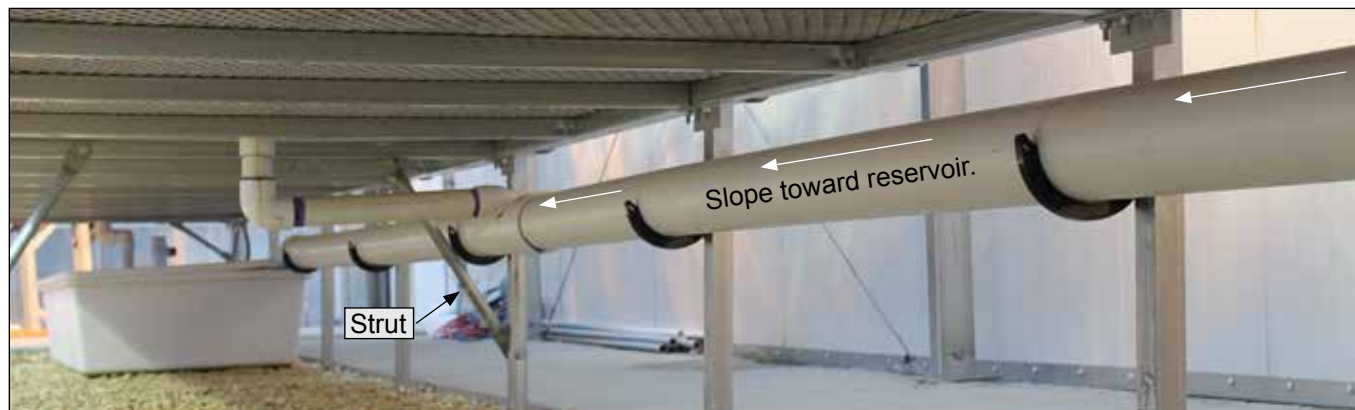


ATTENTION: Cut a hole in reservoir cover for the 4" drain elbow.

Construct drain tube long enough to reach from media bed drain at far end to reservoir at opposite end. Install hangers using two (2) FA4572 Tek screws for each. **Set proper pitch when installing hangers.**

Parts for 4" drain tube:

- 112612 4" Pipe Hanger (A)
- (1) WF0007 90° Elbow (Do not glue to drain pipe.) (B)
- WF4171 4" PVC Pipe (cut to length) (C)
- WF0024 4" Coupler (Use when needed.) (D)
- WF0013 4" End Cap (E)
- FA4572 Tek Screws



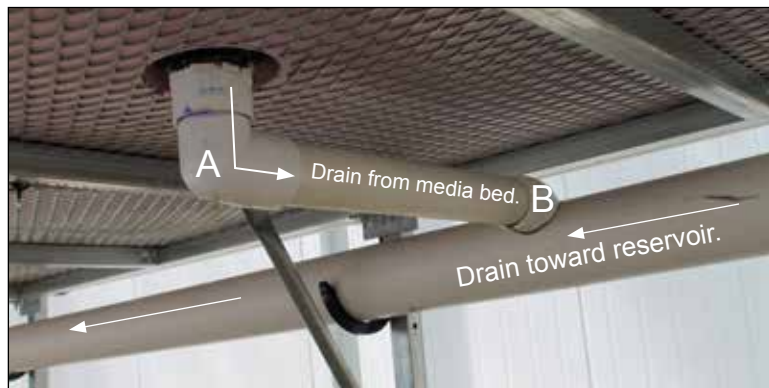
8d

ASSEMBLE AND INSTALL 4" DRAIN LINE TO RESERVOIR – continued

4. After assembling 4" drain tube, set tube in hangers and mark media bed drain hole positions on 4" tube.
5. Rotate drain tube (or remove from hangers) to gain access to mark.
6. Using a drill and 2-1/2" hole saw bit, drill a drain hole in the 4" drain tube at each location. *Drain holes must align with each other to ensure proper assembly.*



7. Clean debris from around hole and rotate drain tube so drain hole faces underside of media bed.
8. Assemble media bed drain tube assemblies.



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Parts for 2" drain to 4" drain tube:

- (1) WF1576 90° Elbow (2") (A)
- (1) 112758 45° Elbow (2") (B)
(Slip x Street)
- 111560 2" PVC Pipe (C)
(cut to length)
- PVC Primer and PVC Cement

ATTENTION: Depending on position of media bed drain (or drains), system may only have a single media bed 2" drain tube that connects to 4" drain tube. One media bed drain may drain directly into reservoir through porthole in cover as shown in Section 8a.

NOTE: Use a small section of 2" pvc to connect 90° elbow (A) to adapter attached to media bed drain bulkhead—photo left. If needed, add extension pipe (C) between bulkhead adapter and 90° elbow (A) as shown in photo.

Fingerling System: Standpipes & Gravel Guards

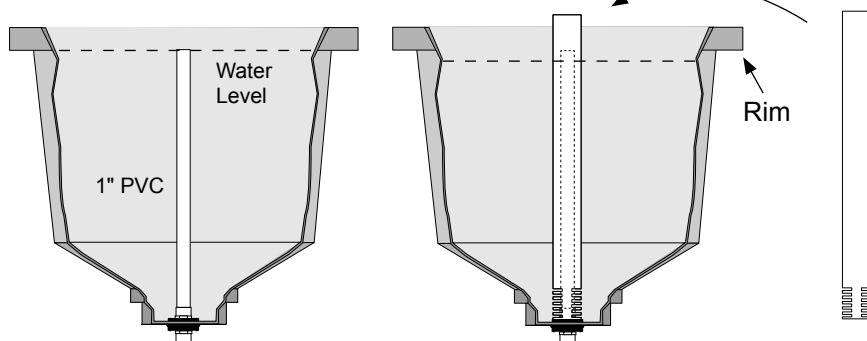
9

INSTALL STANDPIPES: FINGERLING SYSTEM TANKS—50 & 250 Gallon

Complete these steps to cut and install pvc standpipes.

Inner and Outer Standpipe Installation: 50 Gallon Tank

1. Cut a piece of 1" pvc (WF4135) to desired length to set water level in tank. (The longer the pipe, the higher the water level. Keep at or below tank rim.)
2. Apply pvc primer and glue to one end of pipe and insert that end into adapter attached to installed bulkhead inside 50 gallon tank. Allow glue to set.
3. Take the AQ120 2" outside standpipe and slide it over 1" inside standpipe.



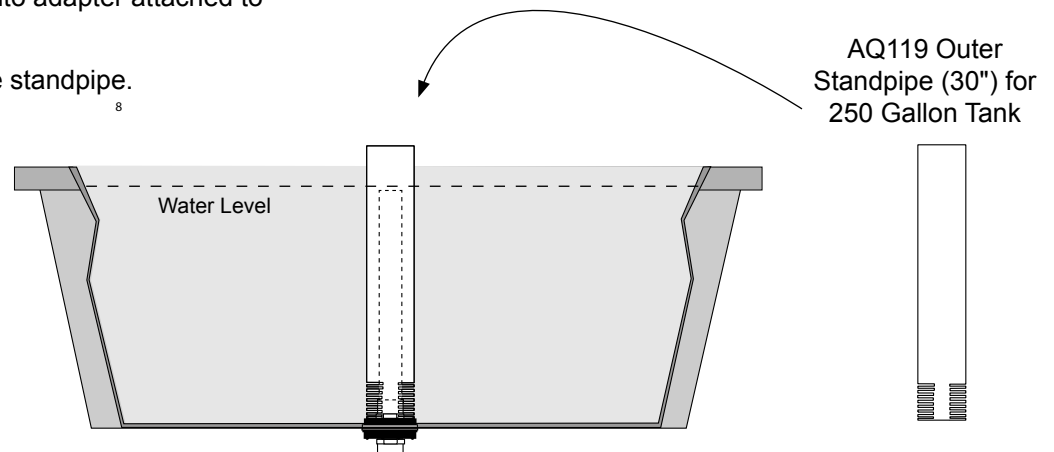
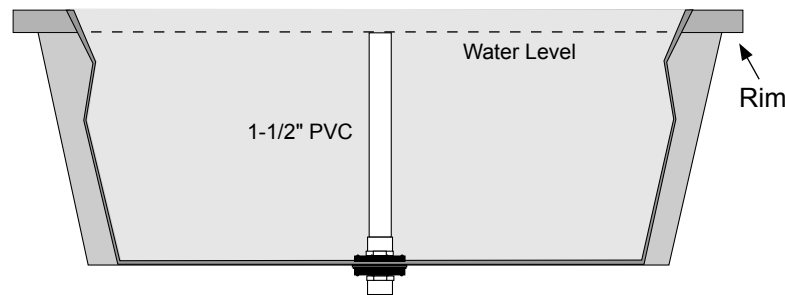
AQ120 Outer Standpipe (24") for 50 Gallon Tank



After installing standpipe in 50 gallon tank, slide AQ106 screen over standpipe. Cut to length as needed. Ensure a good fit; screen prevents fish from passing through slots in standpipe.

Inner and Outer Standpipe Installation: 250 Gallon Tank

1. Cut a piece of 1-1/2" pvc (WF4140) to desired length to set water level in tank. (The longer the pipe, the higher the water level. Keep at or below tank rim.)
2. Apply pvc primer and glue to one end of pipe and insert that end into adapter attached to bulkhead inside 250 gallon tank. Allow glue to set.
3. Take the AQ119 3" outside standpipe and slide it over 1-1/2" inside standpipe.
4. Repeat for all remaining 250 gallon tanks of fingerling system.



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Fifty gallon and 250 gallon tanks include an inner and outer standpipe. Here are the parts for the different tanks and standpipes:

- WF4135 1" PVC Pipe for Inner Standpipe for 50 Gallon Tank (cut to length as noted)
- AQ120 2" Outer Standpipe for 50 Gallon Tank
- WF4140 1-1/2" PVC Pipe for Inner Standpipe for 250 Gallon Tank (cut to length as noted)
- AQ119 3" Outer Standpipe for 250 Gallon Tank
- PVC Primer and PVC Cement

9a

ASSEMBLE BELL SIPHON FOR MEDIA BED

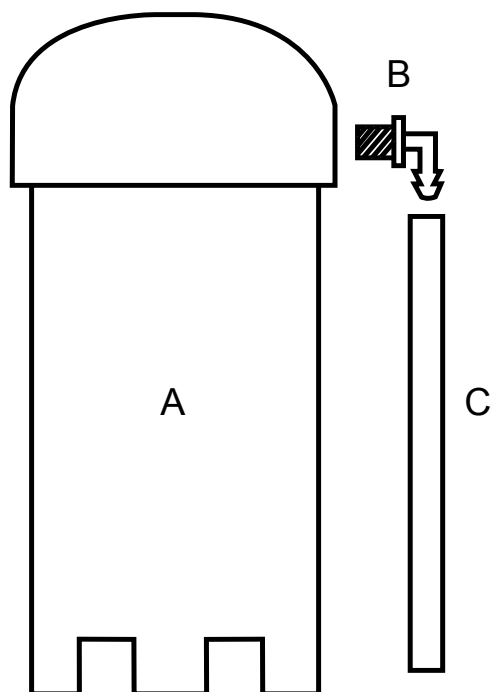
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Complete these steps to assemble each bell siphon:

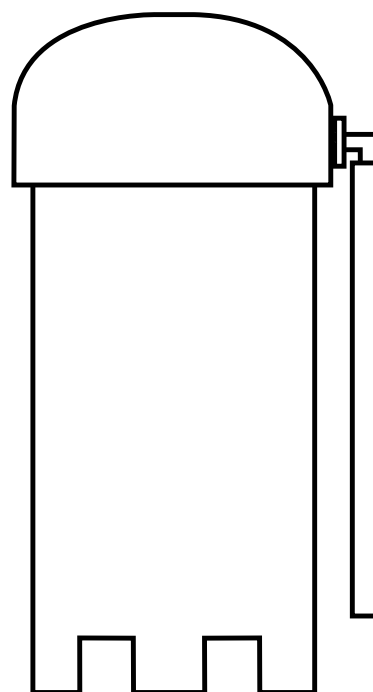
1. Gather parts shown below and listed to the right.
2. Attach the 1/4" clear tubing to barbed nipple of part B.
3. Apply a thin film of DE4007 sealant to threads of part B and thread into bell siphon cap.
4. Allow sealant to dry before use.
5. Repeat to assemble all remaining bell siphons.
6. Continue with next procedure.

Parts for each bell siphon assembly:

- (1) AQ125 Bell Siphon (A)
- (1) WF0025 1/4" MT x 1/4" Bard 90° elbow (B)
- WF1050A 1/4" Clear Tubing (C)
- DE4007 Sealant



Assembled Bell Siphon



INSTALL STANDPIPES AND GRAVEL GUARDS: FINGERLING SYSTEM MEDIA BEDS

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Complete these steps:

1. Review diagrams below and begin by cutting a piece of 2" pvc (111560) so distance from liner bed to top of standpipe is 7" **when pipe is installed** in adapter of bulkhead assembly.
2. Insert one end of standpipe into adapter of bulkhead assembly. Check height to top of installed standpipe. Adjust as needed so result is 7". (Do not glue standpipe to adapter.)
3. Next, center the bell siphon assembly over standpipe.
4. Set a WF1982 coupler next to bell siphon as shown below and place a WF2995 1" slip cap inside coupler with open end of cap up.
5. Insert free end of 1/4" clear tube into 1" slip cap, which is inside coupler.

NOTE: Verify that hose end does not bottom out in slip cap. Trim hose so it remains inside cap without touching bottom. See diagram below.

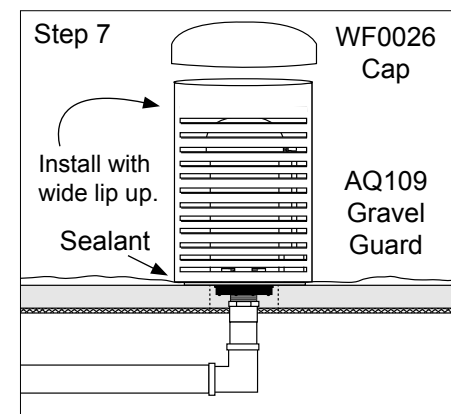
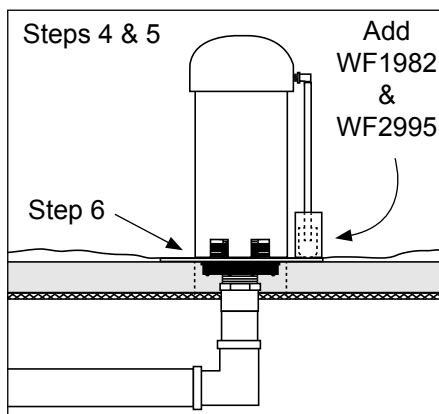
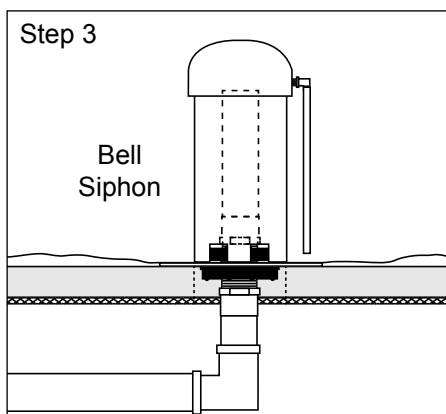
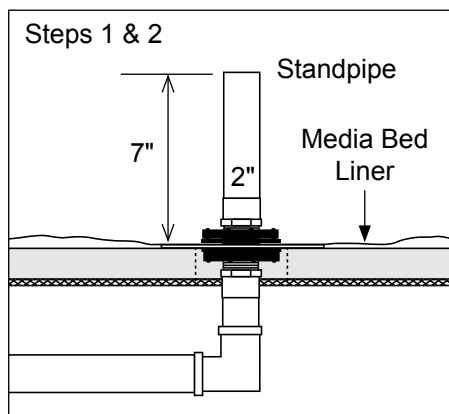
6. Clean liner surface around bell siphon using a dry towell to remove dirt and debris.
7. Apply a bead of DE4007 sealant along bottom edge of AQ109 gravel guard. (This is edge where slots are closest to.) Carefully place guard over bell siphon and press lightly to seat against liner.

ATTENTION: For proper operation, position widest lip of gravel guard at top for cap installation.

8. Spread excess sealant around gravel guard base and **allow to dry before adding gravel or water**.
9. Repeat steps to install remaining media bed liner standpipes, bell siphons, and gravel guards.

Parts for standpipes:

- 111560 2" PVC Pipe—Standpipe for Bulkhead Assembly—Media Bed Liner (cut to length as noted)
- WF1982 1-1/2" Coupler (Slip x Slip)
- WF2995 1" Slip Cap
- Bell Siphon (from previous page.)
- AQ109 Gravel Guard & WF0026 8" Cap
- DE4007 Sealant (for Gravel Guard installation)



9b

INSTALL STANDPIPES AND GRAVEL GUARDS: FINGERLING SYSTEM MEDIA BEDS — continued

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Photos and diagram on this page show gravel guard installed in media beds. Photos at right show gravel guard with and without cap. Beds are filled with clay pebbles. **Do not glue cap on gravel guard.**

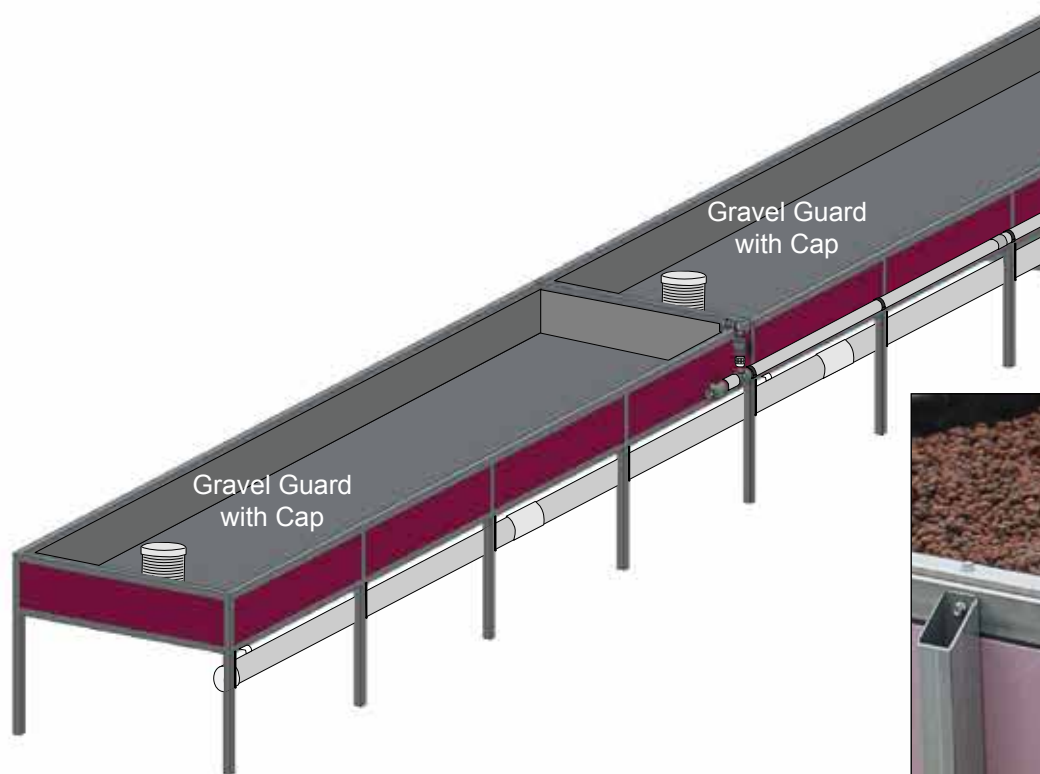


Photo (top right) shows gravel guard with cap installed. Lower-right photo shows gravel guard without cap.

Exit Pipe: Grow-Out System Sump & Biofiltration Tanks

10

INSTALL EXIT PIPES: GROW-OUT SYSTEM SUMP & BIOFILTRATION TANKS

Use diagrams below to install pipes for 140 gallon sump tank and 410 gallon biofiltration tank.

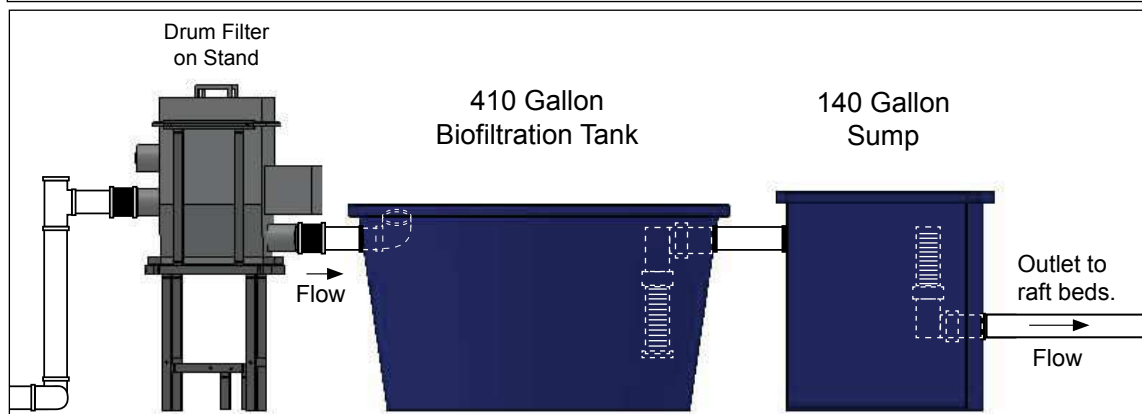
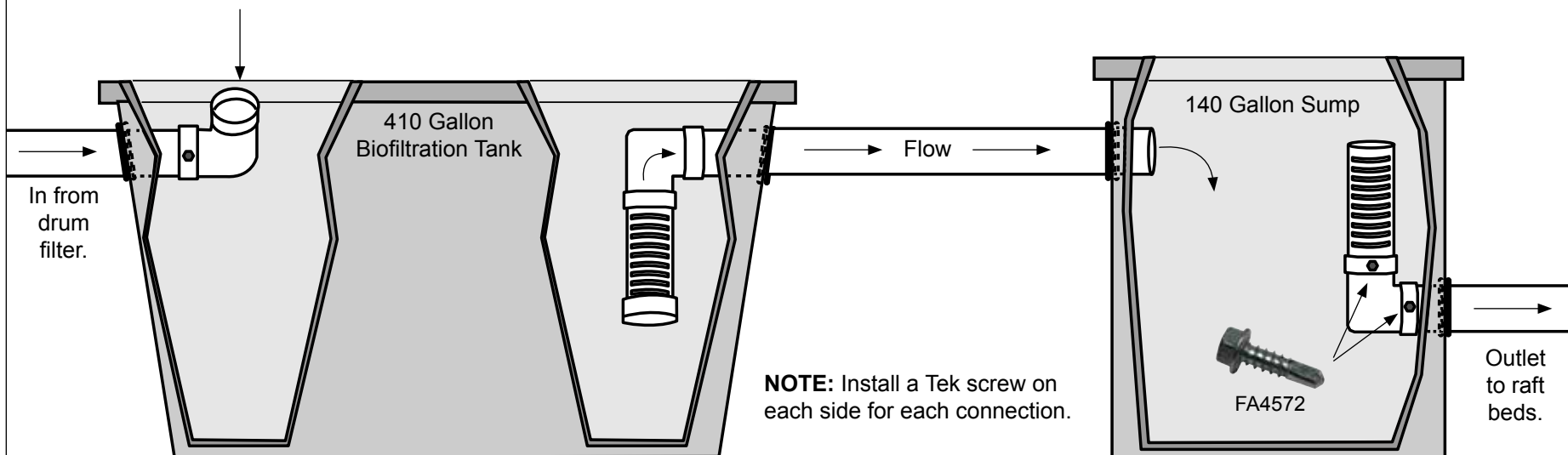
ATTENTION: To allow for cleaning and maintenance, **do not glue slotted pipe to 90° elbow in 140 gallon sump.** Instead, use two (2) FA4572 Tek screws to secure slotted pipe to elbow. Secure 4" cap in 140 gallon tank to slotted pipe using two (2) FA4572 Tek screws. **Glue slotted pipe, cap, and elbow in 410 gallon tank.**

COLOR CODE: YELLOW & RED

Parts for pipe installation:

- AQ118 4" Slotted Exit Pipes
- WF0013 4" PVC Cap
- WF0007 4" 90° Elbows
- FA4572 Tek Screws

ATTENTION: Turn (adjust) four-inch 90° elbow as needed to control water level in drum filter.



Aeration System: Fingerling and Grow-Out Systems

11

AERATION SYSTEM ASSEMBLY AND INSTALLATION

This commercial aquaponic system includes basic components for aeration. A single air pump provides air for the fingerling and grow-out systems. **PVC pipe and related fittings to transport air from air pump to the different tanks are not included.** These components can be purchased locally, or from your aquaponic sales representative. Recommended supply line construction details:

- Use 1-1/2" Schedule 40 pvc pipe and fittings to construct aeration lines to tanks.
- Install a shutoff valve at each tank to regulate (or shutoff) air flow for maintenance and cleaning.
- Mount air pump a few feet above floor in a clean area away from water. Air pump is audible and runs continuously; consider this when determining placement in building. If possible, do not install in a work area. Position behind sound-absorbing panels to help dampen noise.
- Allow adequate space around pump for easy access for maintenance and cleaning.

COLOR CODE: BLACK



Photo above shows 115454 blower motor mounted against wall using customer-supplied materials. (Actual blower may differ from what is shown.)

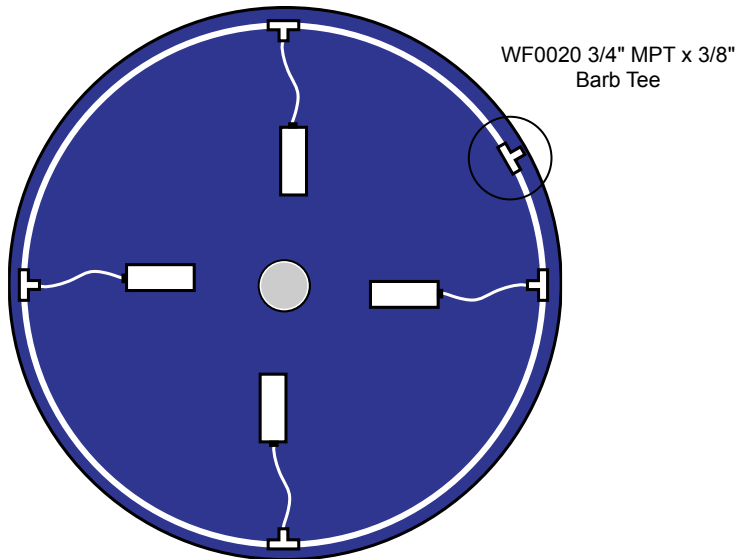
Photo below shows air lines, barb tees, and clamps installed around edge of tank. Actual tank and number of clamps and tee fittings may differ.



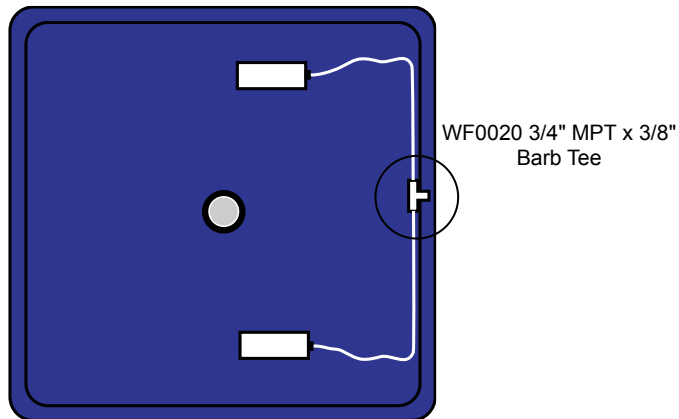
AERATION SYSTEM ASSEMBLY AND INSTALLATION – FINGERLING & GROW-OUT SYSTEM AIR STONE PLACEMENT

ATTENTION: Ensure that all tube lengths in each tank are the same.

FINGERLING SYSTEM TANKS

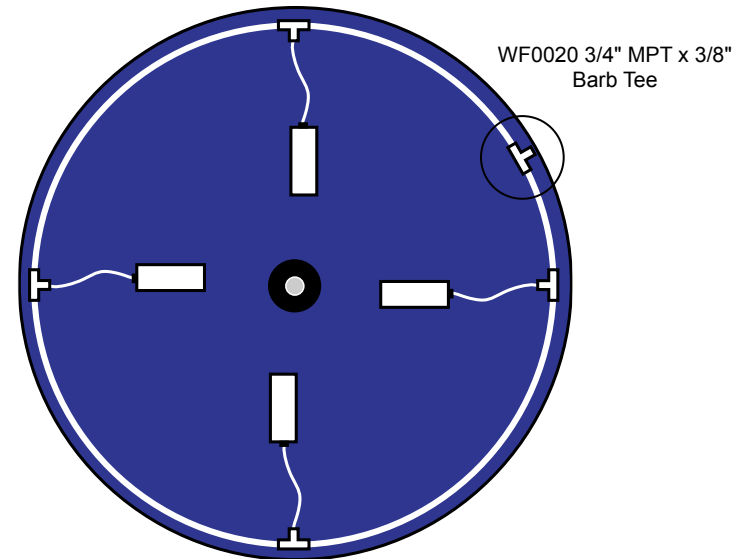


250 Gallon Tank — Top View

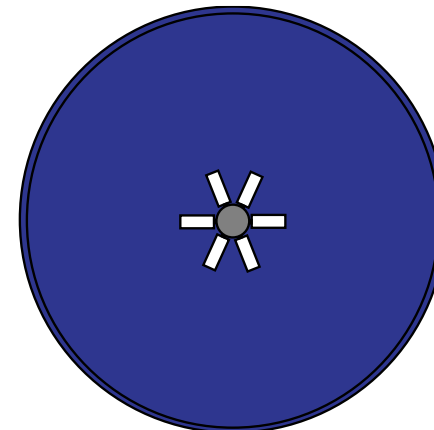


50 Gallon Tank — Top View

GROW-OUT SYSTEM TANKS



1,200 Gallon Tank — Top View



410 Gallon Tank — Top View

11

AERATION SYSTEM ASSEMBLY AND INSTALLATION – FINGERLING SYSTEM

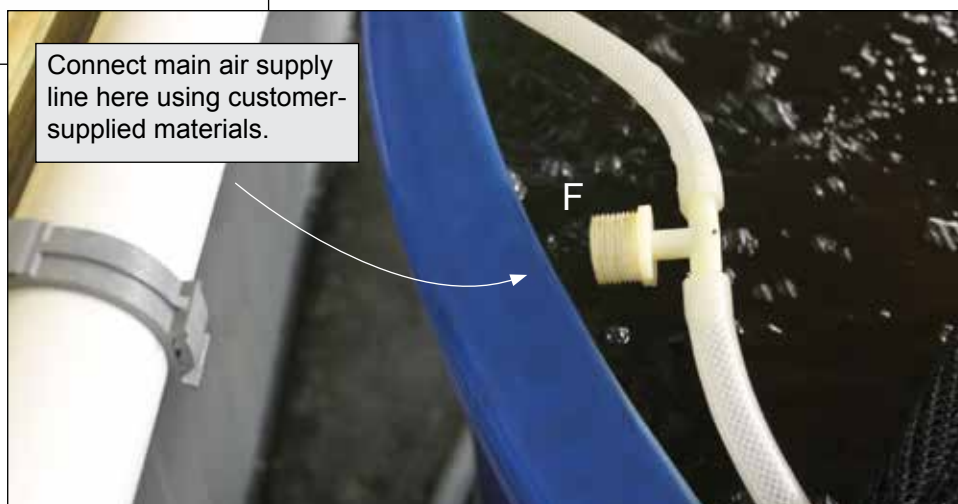
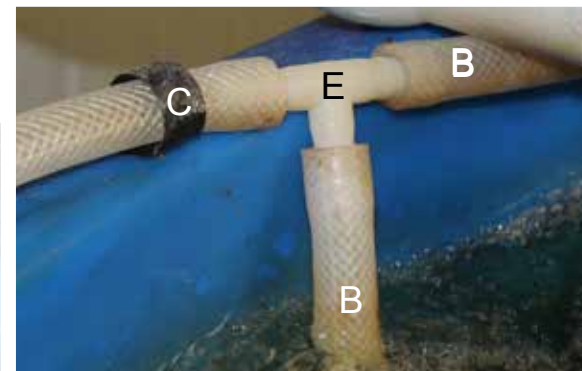
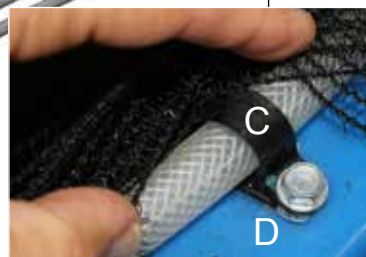
COLOR CODE: BLACK

Install four (4) stones in each 250 gallon tank and two (2) stones in 50 gallon tank. Space clamps as needed to keep hose on edge of tank.



Use these parts for fingerling aeration system:

- (10) AQ116 6" Airstone 3/8" Barb (A)
 - WF1060A Braided Hose (B)
 - FA8006 Loop Clamps (C)
 - FA4572 Tek Screw (D)
 - (8) WF0021 3/8" Barb Tee (E)
 - (3) WF0020 3/4" MPT x 3/8" Barb Tee (F)
- Connect main air supply line to these.



11

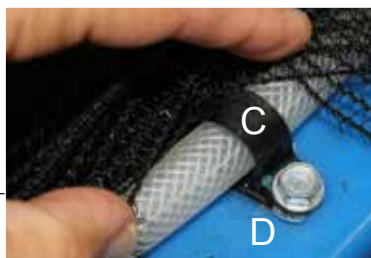
AERATION SYSTEM ASSEMBLY AND INSTALLATION – GROW-OUT SYSTEM

Repeat steps shown on previous page and refer to photos to install aeration components for grow-out system tanks **using parts at right**.

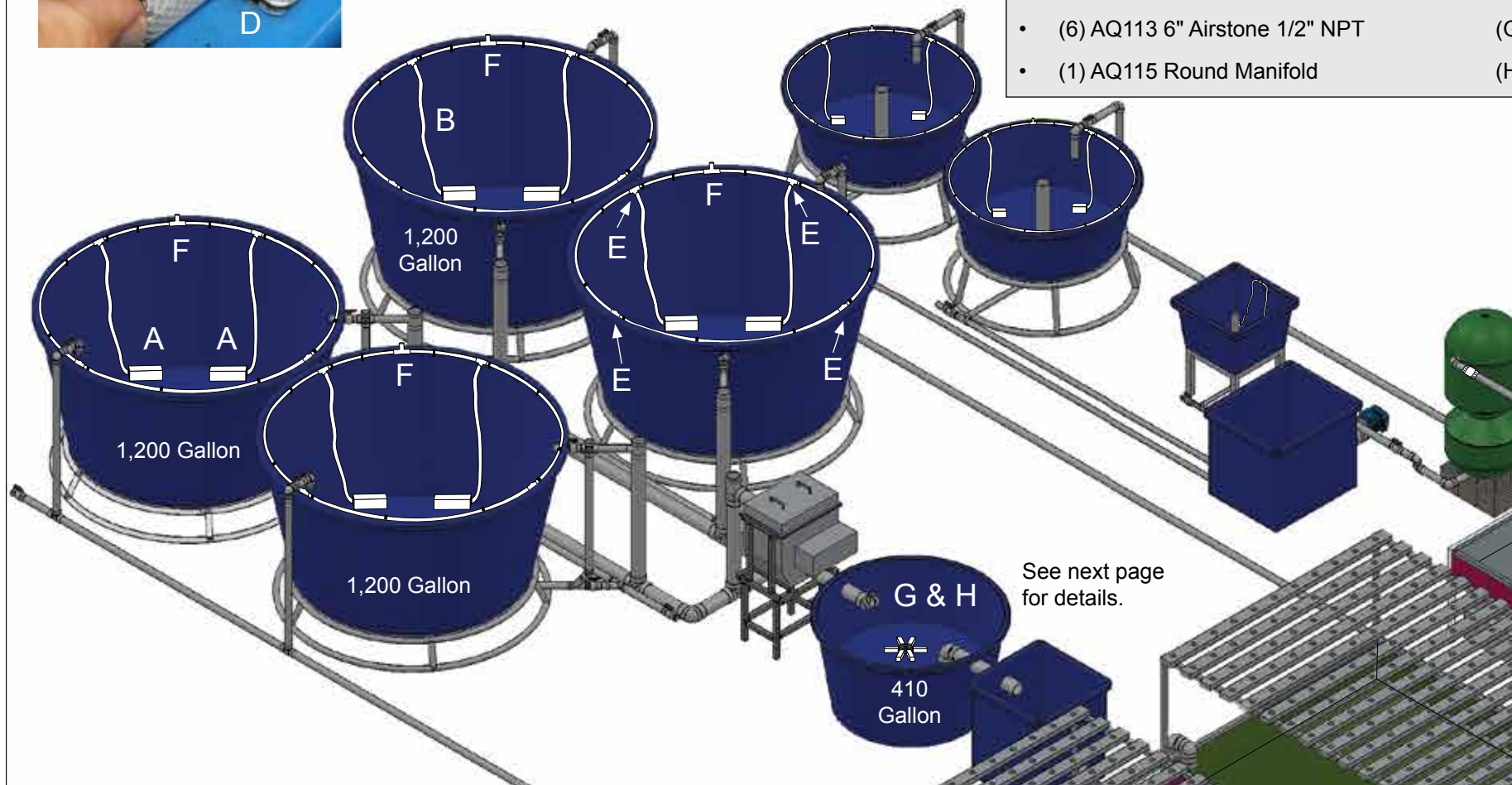
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Use these parts for grow-out aeration system:

- (16) AQ114 9" Airstone 3/8" OD (A)
- WF1060A Braided Hose (B)
- FA8006 Loop Clamps (C)
- FA4572 Tek Screw (D)
- (16) WF0021 3/8" Barb Tee (E)
- (4) WF0020 3/4" MPT x 3/8" Barb Tee (F)
- (6) AQ113 6" Airstone 1/2" NPT (G)
- (1) AQ115 Round Manifold (H)



Install four (4) stones in each 1,200 gallon tank and six (6) stones in 410 gallon tank. Space clamps as needed to keep hose on edge of tank.



11

AERATION SYSTEM ASSEMBLY AND INSTALLATION – GROW-OUT SYSTEM

COLOR CODE: BLACK



Air Stone Assembly for 410 Gallon Biofiltration Tank: Using parts shown above, attach AQ113 air stones to AQ115 6-way manifold.

IMPORTANT: To prevent contamination, **do not use any tape or thread sealant** when attaching air stones to round manifold.

Photo at right shows main 1-1/2" air line attached to ceiling. Additional customer-supplied materials are used to connect air supply to center port of air stone manifold. PVC pipe (3/4" WF4130) and shut-off valve (WF3311) shown are included with this commercial aquaponic system.



Prepare Plant Rafts

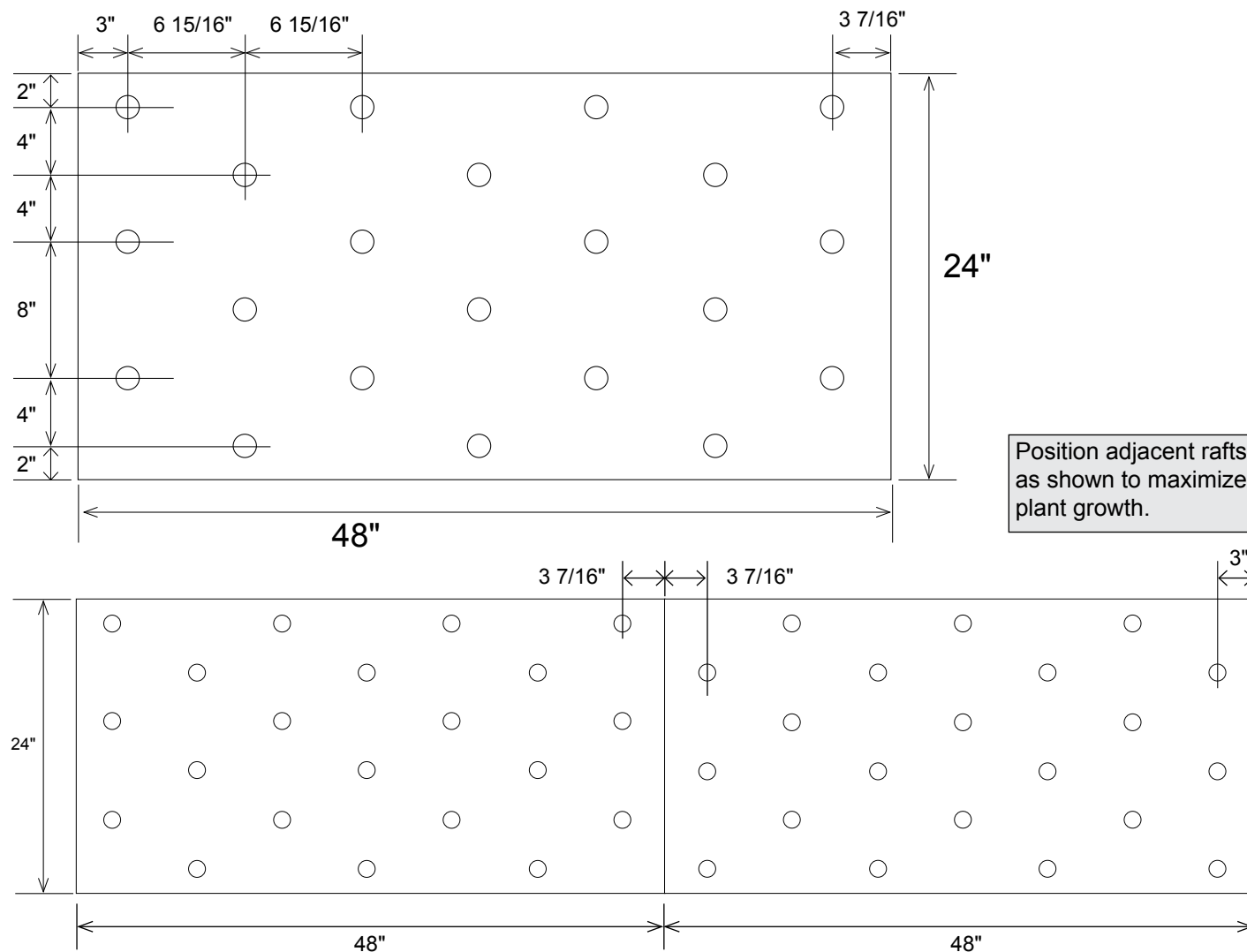
12

PREPARE PLANT RAFTS

IMPORTANT: Read the system cycling information near the beginning of this manual *before* drilling plant sites in polystyrene panels. Undrilled panels can be used to cover raft beds during the cycling process.

COLOR CODE: RED

The templates below show one of many ways to prepare plant rafts. (There are other patterns.) Each has its advantages. Determine the best pattern for your growing needs and prepare the 4' x 8' rigid foam boards as needed. Rafts can be cut in half or quarters (shown) for easier handling and harvesting. Layout desired pattern and drill holes. Hole size depends on what plants you intend to grow and media you will use. Consult with your sales representative for additional information about growing plants in your aquaponic system. Hole size shown is 1-3/8". **Top diagram shows a 24" x 48" panel.**



A step bit* allows for drilling a uniform size hole through the rigid foam board. It also allows you to drill a tapered hole that works better for some media. Determine which type of hole is needed for your planting needs and prepare the rafts accordingly.

Experiment with different bits until desired results are achieved. For net pots, do not use a step bit.

*Step bit is not included. Purchase locally if needed.



Photo above shows drilling holes in the rigid foam board using a step bit. Hole pattern show above is staggered.

Install Shade Cloth & Bird Netting

13

INSTALL SHADE CLOTH & BIRD NETTING

When installed, shade cloth and bird netting help prevent fish from jumping out of tanks once tanks are populated. Review photos on this page for an example of how to cover tanks. Follow these guidelines:

- Cut bulk netting or shade cloth to size for each tank.
- Cut larger than tank top to allow extra to drape over tank edges for anchoring purposes.
- Add an extension (customer-supplied) to stand pipes in 50 and 250 gallon fingerling tanks (if needed) to keep netting above water surface if needed.
- Cut material around supply lines as needed to get the best fit. See photo — lower right.
- Use an anchoring method that is easy to undo to allow access to tank for fish harvest and regular maintenance.

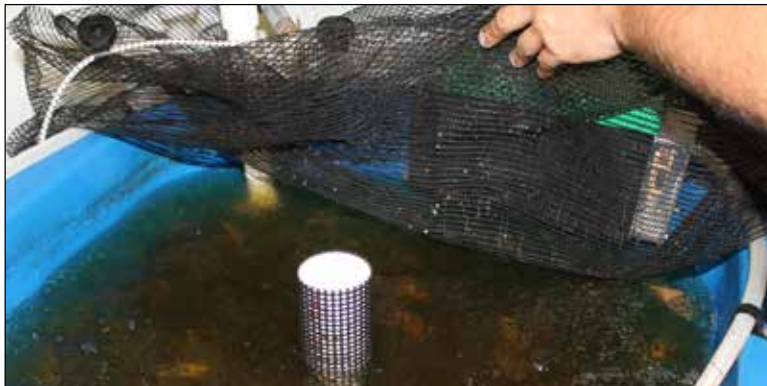
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Suggested parts to cover tanks:

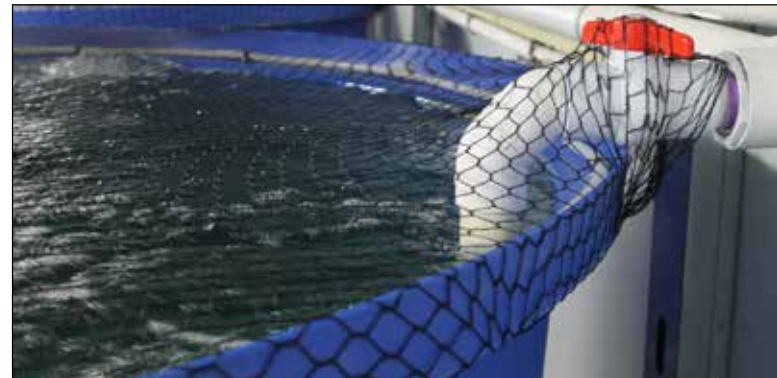
- CC3100 Shade Cloth (included) – used for 50 & 250 gallon tanks of fingerling system.
- 107438 Shade Clips (included) – used to secure shade cloth.
- TC2630A Bird Netting (included)
- CC5310 3/16" Black Rope (included) – used to secure both shade cloth and bird netting.
- PVC extension for standpipe (customer-supplied—not included. Use on 50 and 250 gallon tanks if needed.)
- Bungee Chords or Rubber Straps (customer-supplied—not included. May not be needed.)



Shade cloth covering fingerling tanks.



Bird netting covering grow-out system tanks.



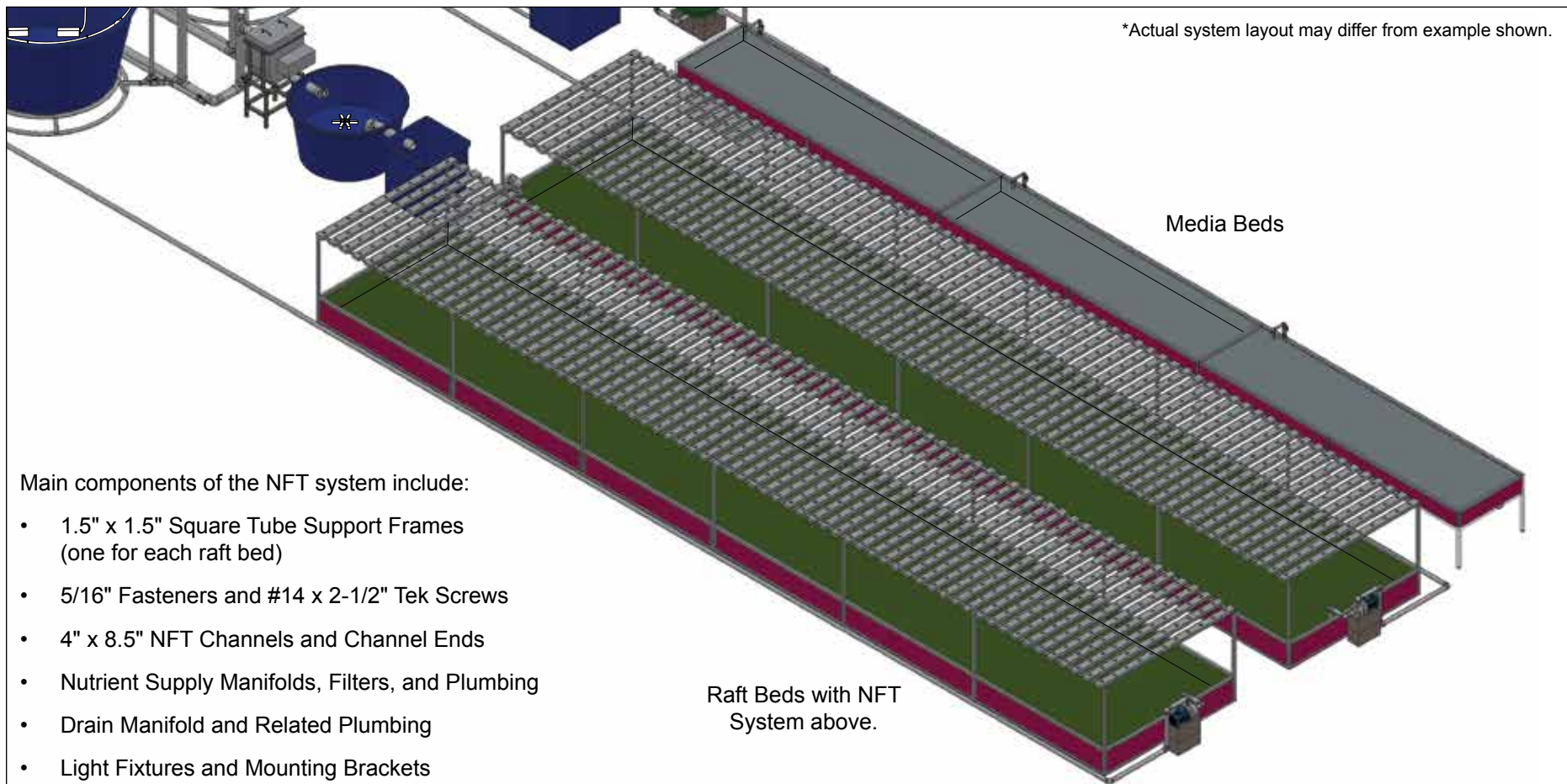
NFT System Assembly

14

OVERVIEW — NFT FRAME

COLOR CODE: GRAY

When assembled and installed, the NFT system for the commercial aquaponic system* is installed over each raft bed. NFT frame supports all NFT channels, supply and drain plumbing, and lighting system. There are two (2) identical NFT frames for this system. Each frame supports 68 NFT channels and 30 light fixtures.



Main components of the NFT system include:

- 1.5" x 1.5" Square Tube Support Frames (one for each raft bed)
- 5/16" Fasteners and #14 x 2-1/2" Tek Screws
- 4" x 8.5" NFT Channels and Channel Ends
- Nutrient Supply Manifolds, Filters, and Plumbing
- Drain Manifold and Related Plumbing
- Light Fixtures and Mounting Brackets

Additional Customer-Supplied Materials Needed:

- All wire, conduit, electrical fittings, and junction boxes needed to connect lights to power.
- Conduit clamps for electrical conduit.
- Supports and platforms to span raft bed to install NFT frame and lights.

ATTENTION: Enlist the services of a qualified electrical contractor to connect all lights and pumps to a main power supply. Contractor to be familiar with local and regional codes and with installing similar electrical systems in similar environments.

14

NFT FRAME ASSEMBLY

COLOR CODE: GRAY

There are different ways to assemble the NFT frame. Available space, number of assistants, and time can all affect the assembly steps. The procedure that follows is one way to assemble the NFT frame. At least one assistant is needed. Some procedures can occur simultaneously. Read all steps before you begin to best determine how to start. **Complete assembly of both aquaponic raft beds before starting this procedure.**

LOCATE ALL FRAME PARTS

Use this information to locate frame parts for the NFT frames:

- Color Code for the NFT system is GRAY.
- All frame tube parts begin with the suffix NFTS15P.

IMPORTANT: Light fixtures are installed last and after frame is fully assembled. Store fixtures and bulbs in a location to prevent damage.

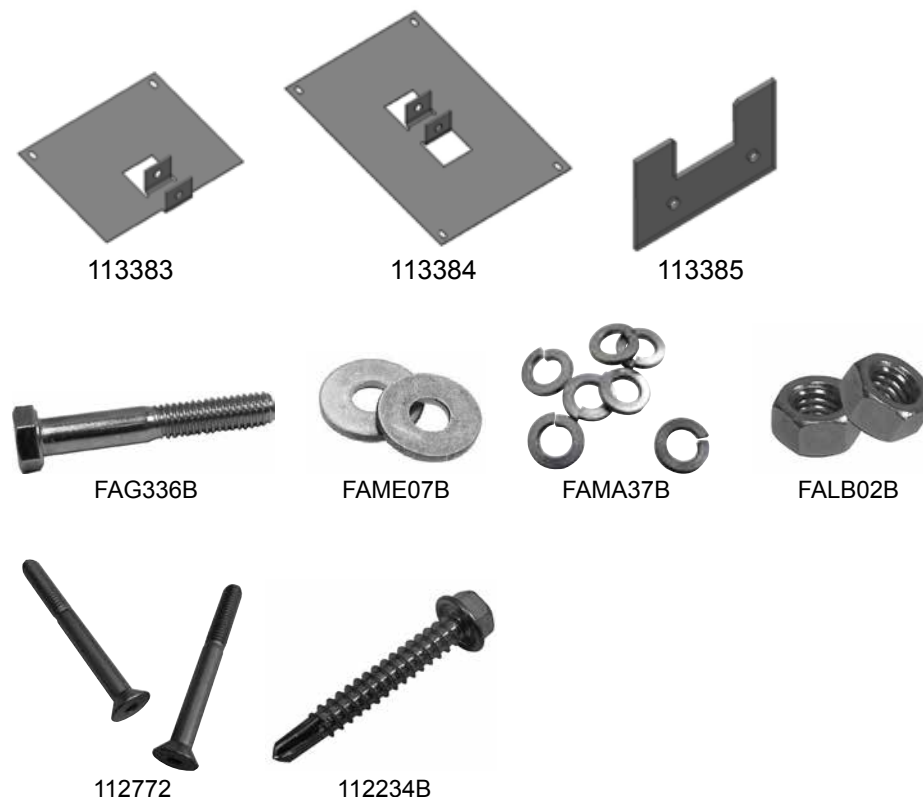
PLATFORM TO COVER RAFT BED DURING FRAME CONSTRUCTION

Frame assembly for the NFT system will occur over the assembled raft beds. To prevent damage to raft bed liners during frame assembly, create a platform capable of supporting the weight of all who will be assisting with this procedure.

Platform should span width of raft bed and prevent tools and parts from dropping onto bed liner. Platform should be portable so it can be moved as needed during frame construction. See diagram later in this section.

BASIC STEPS TO ASSEMBLE ONE (1) FRAME FOR NFT SYSTEM

1. Locate all NFT frame parts, light brackets, and related fasteners.
2. Determine high and low sides of frame for NFT system and assemble leg and cross brace frame supports.
3. Begin at one end of a raft bed and assemble NFT system frame in sections working toward the other end until complete.
4. Attach light brackets (113383 & 133384) to the NFTS15P100TSB cross supports. See diagrams on next page for details.
5. Repeat to assemble frame for remaining raft bed.
6. Attach lights to light brackets.
7. Enlist the services of an electrician to properly wire all lights. Customer supplies all materials to connect lights to each other and to power.
8. Continue by installing all plumbing fixtures and assemblies.



WARNING: Enlist the services of an experienced electrician when wiring the light system and connecting power to all electrical devices and lights.

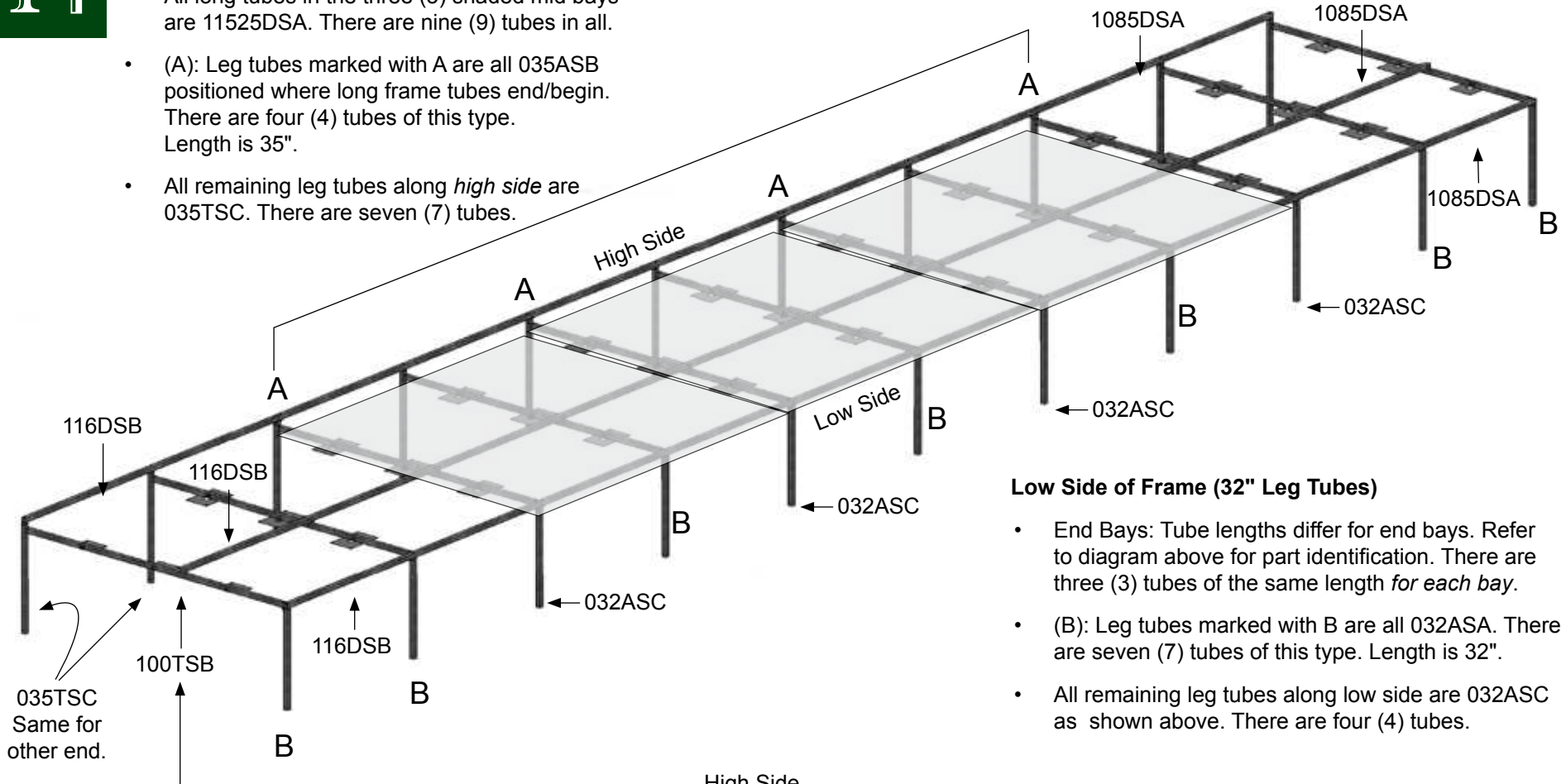
All wiring to be completed according to established codes and practices.

IMPORTANT: Before attaching light fixtures to frame, consult with the electrician to determine how best to install fixtures to facilitate the installation of customer-supplied wire and conduit. Fixtures include one outlet for wiring. Position fixtures as needed to connect to other fixtures.

14

High Side of Frame (35" Leg Tubes)

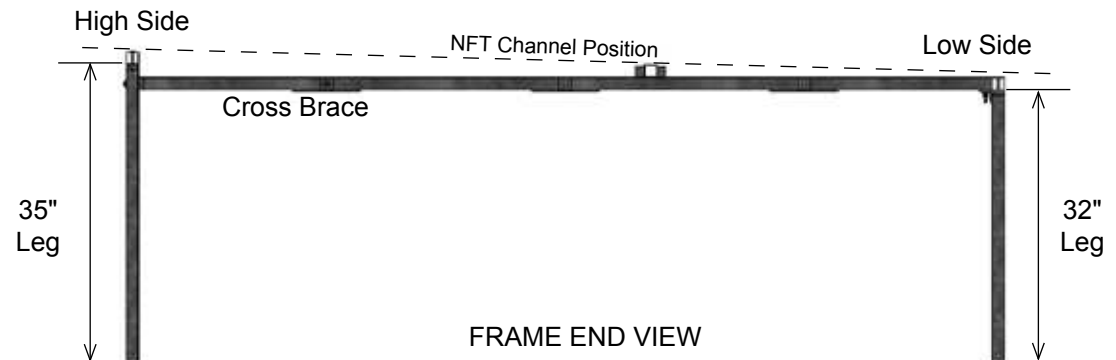
- All long tubes in the three (3) shaded mid bays are 11525DSA. There are nine (9) tubes in all.
- (A): Leg tubes marked with A are all 035ASB positioned where long frame tubes end/begin. There are four (4) tubes of this type. Length is 35".
- All remaining leg tubes along *high side* are 035TSC. There are seven (7) tubes.



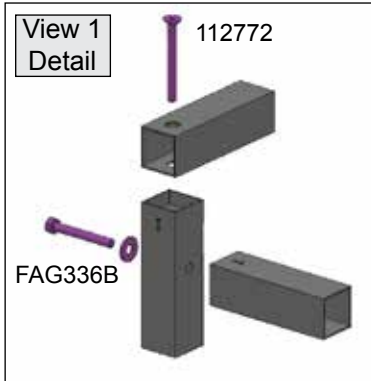
ATTENTION: All tubes between the high side legs and low side legs are 100TSB. Light brackets attach to these cross supports. There are eleven (11) tubes of this type.

Low Side of Frame (32" Leg Tubes)

- End Bays: Tube lengths differ for end bays. Refer to diagram above for part identification. There are three (3) tubes of the same length *for each bay*.
- (B): Leg tubes marked with B are all 032ASA. There are seven (7) tubes of this type. Length is 32".
- All remaining leg tubes along low side are 032ASC as shown above. There are four (4) tubes.

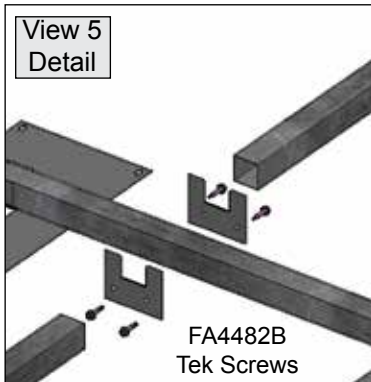
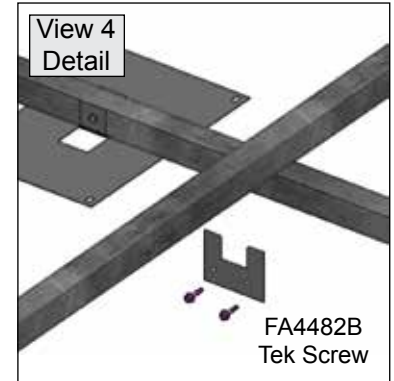
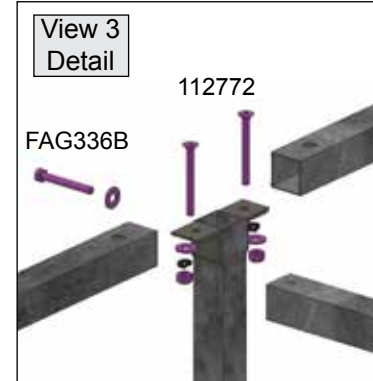


NFT System – Main Frame Connection Details

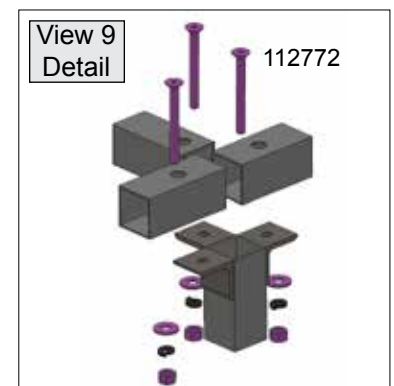
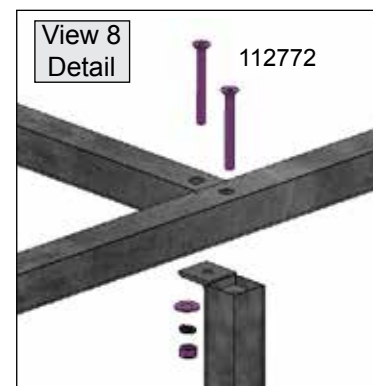
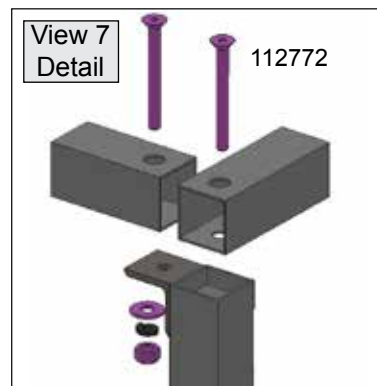
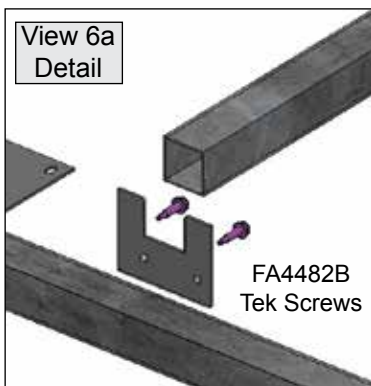
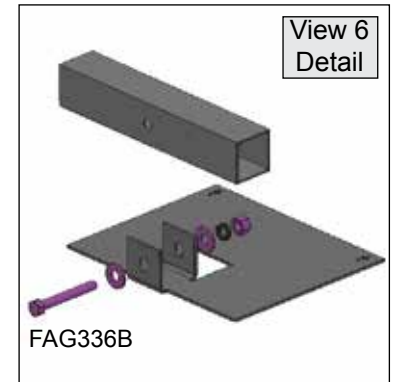
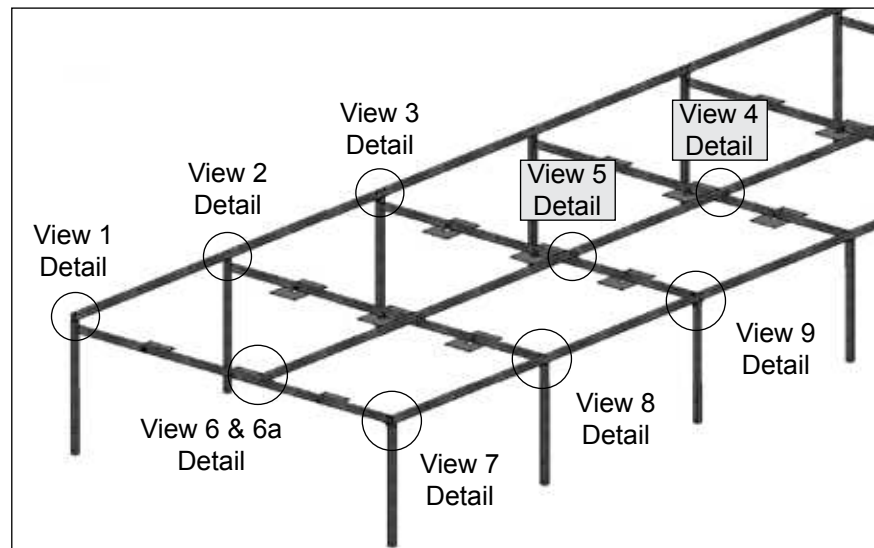


Washers & Nuts Used:

- FAME07B flat washers
- FAMA37B lock washers
- FALB02B nuts



Install two (2) 113385 supports where tubes meet.

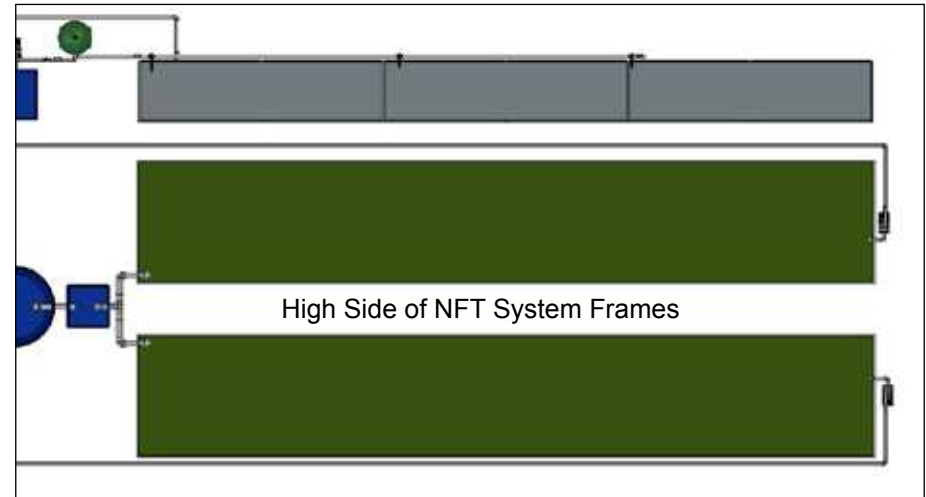
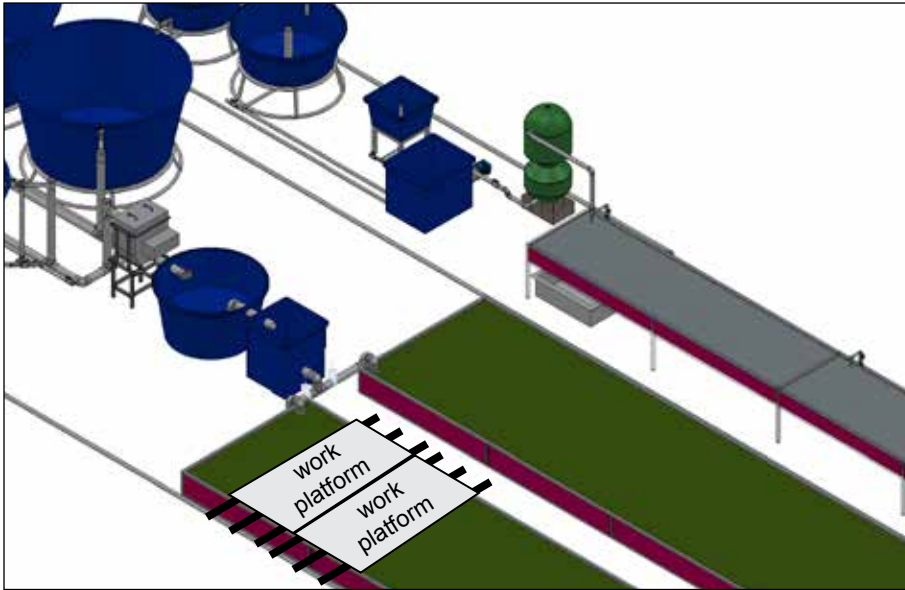


14

Complete these steps:

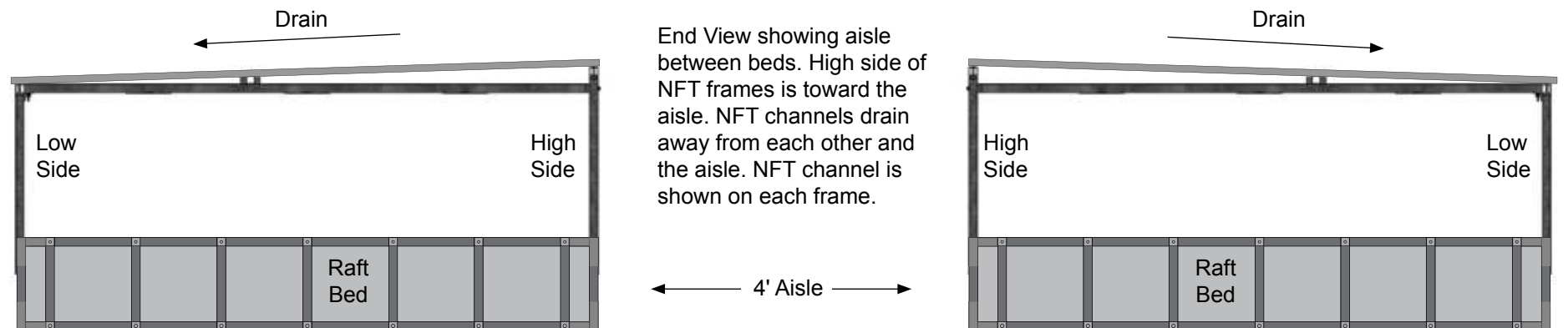
1. Build a work platform to span across raft bed. Platform should be portable and capable of supporting those who will be using it. Platform also protects liner from damage if frame parts and tools are mishandled. Customer-supplied plywood and dimensional lumber is needed.

COLOR CODE: GRAY



Position high side of NFT system frame at center aisle between raft beds. Diagram above shows top view of raft beds and media bed.

2. Review diagrams on this page to determine how NFT system frames install over each raft bed. High side of each frame is located at center aisle between raft beds.



3. After work platform materials are gathered, continue with the assembly steps.

14

FRAME ASSEMBLY

This procedure describes beginning at one end of a raft bed and assembling the NFT frame in sections. Refer to main NFT frame diagram for part identification.

Complete these steps:

1. Assemble one (1) support section of the NFT frame (shown below) using one 35" leg (035TSC), one 32" leg 032ASA, and one 100" cross brace (100TSB). Verify hole position of frame members. *Position large hole of cross bar up to receive the head of the 112772 flat head bolts. Flat head bolts will be flush with surface of tube when installed correctly. Do not over-tighten.*
2. With assistance, begin at one end of the raft bed and position assembly with the long leg toward aisle between raft beds.
3. Set height from top of raft bed to underside of cross brace at 24" and clamp frame legs to first beveled support of raft bed on each side. (See diagram — lower right.)

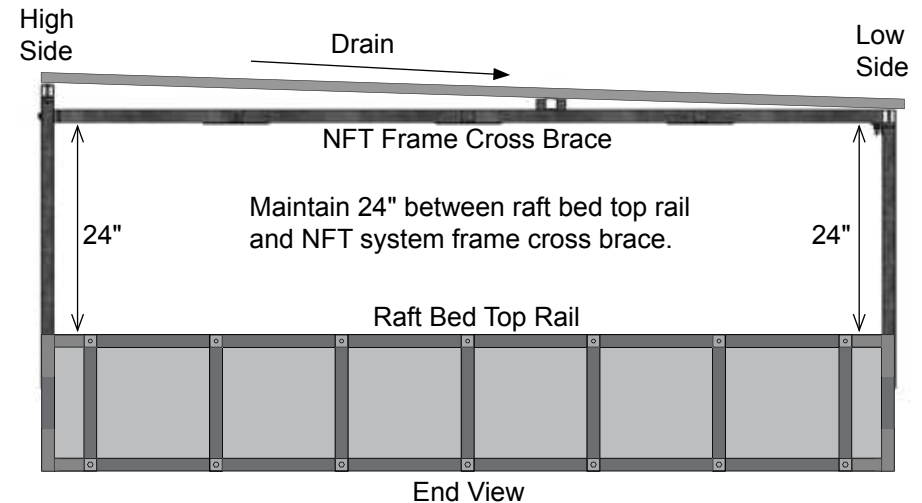
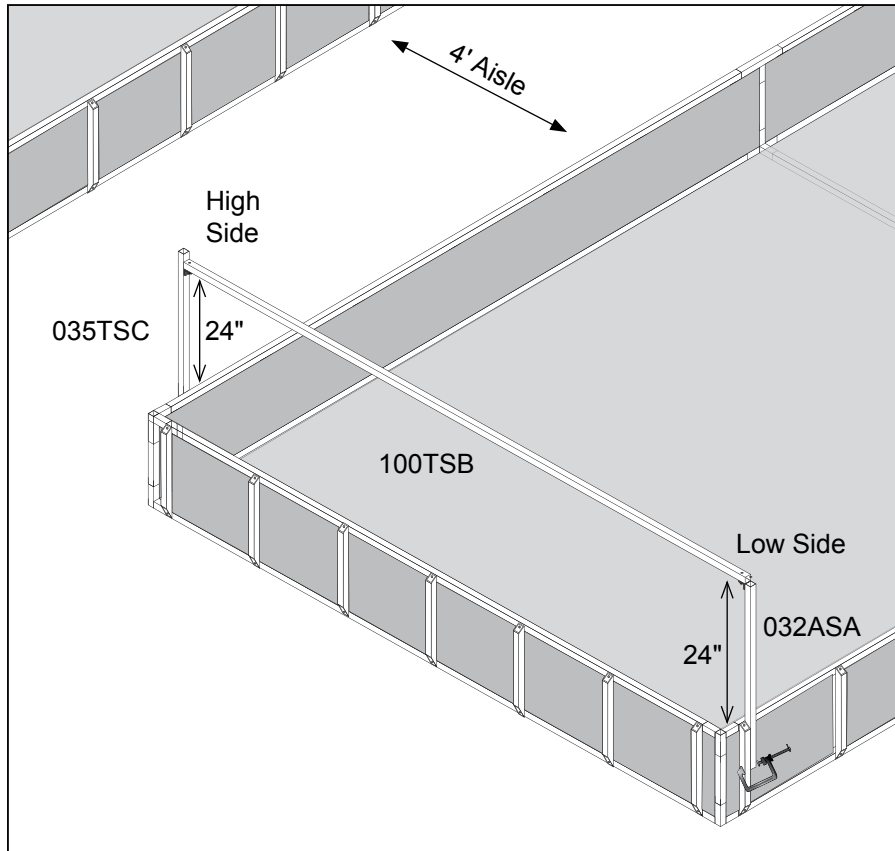
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Required Tools:

- C-clamps to hold frame legs in place
- 6' level (or longer)
- Wrench and socket and ratchet set that includes 1/2" tools for 5/16" nuts and bolts
- Tape measure
- Drill and Tek screw driver (100441) to install Tek screws
- 3/16" hex (Allen) wrench—preferably one that can be used in a socket to operate with a drill.

Hardware:

- FAME07B Flat Washers (5/16")
- FAMA37B Lock Washers (5/16")
- FAG336B Hex Bolts (5/16" x 2-1/2")
- 112772 Flat Head Bolts (5/16" x 3")
- 112234B Tek Screw (#14 x 2-1/2")



FRAME ASSEMBLY—continued

4. Verify that legs are plumb and cross bar is level. Adjust as needed and recheck. See diagram below.

ATTENTION: This starter support section of frame drives the remainder of NFT system frame assembly. Ensure dimensions are correct and frame section is plumb and cross bar level.

5. Using the 112234B Tek screws, attach legs to beveled supports of raft bed using drill and 100441 nut driver.

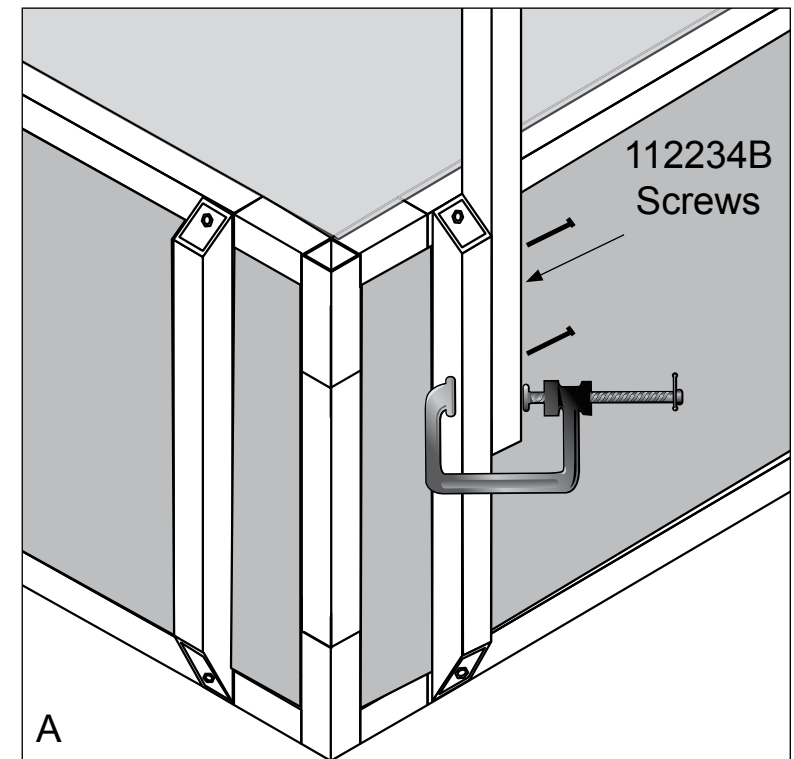
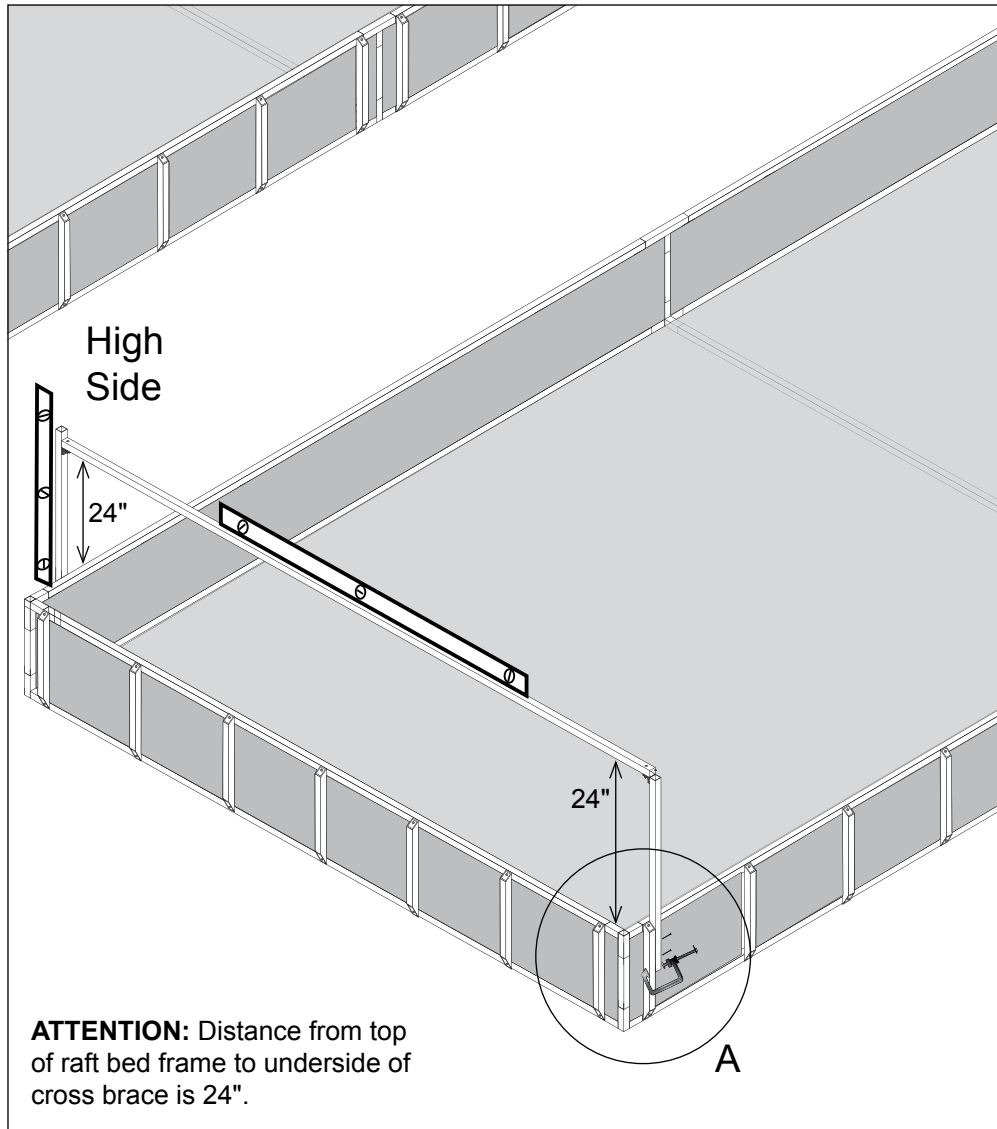
COLOR CODE: GRAY

Hardware:

- FAME07B Flat Washers (5/16")
- FAMA37B Lock Washers (5/16")
- FAG336B Hex Bolts (5/16" x 2-1/2")
- 112772 Flat Head Bolts (5/16" x 3")
- 112234B Tek Screw (#14 x 2-1/2")

Frame Tubes and Fasteners:

- 112375 Beveled Square Tubes
- FA4482B Tek Screws (#14 x 1")

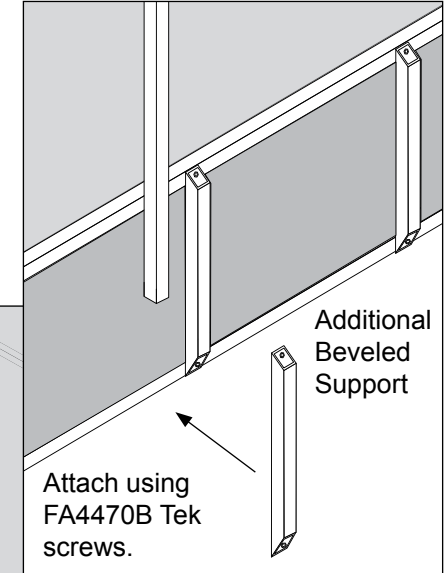


NFT System – Frame Assembly

FRAME ASSEMBLY—continued

6. Assemble another support section of the NFT frame (shown below) using one 35" leg (035ASB), one 32" leg (032ASC), and one 100" cross brace (100TSB). Verify hole position of frame members. **This is the end support of first frame section.** See below.
7. For this first 116" section, select two (2) 116DSB 116" frame tubes. Loosely connect these to the first frame support attached to frame and to the second assembled support. **Assistants are required for the next few steps.** Use the 112772 flat head bolts and 5/16" hardware noted on previous page.
8. Carefully lift, set height above raft bed, and clamp in place. Plumb vertical tubes and ensure all horizontal tubes are level. Tighten all fasteners and secure vertical tubes to raft bed frame. See diagram to the right.

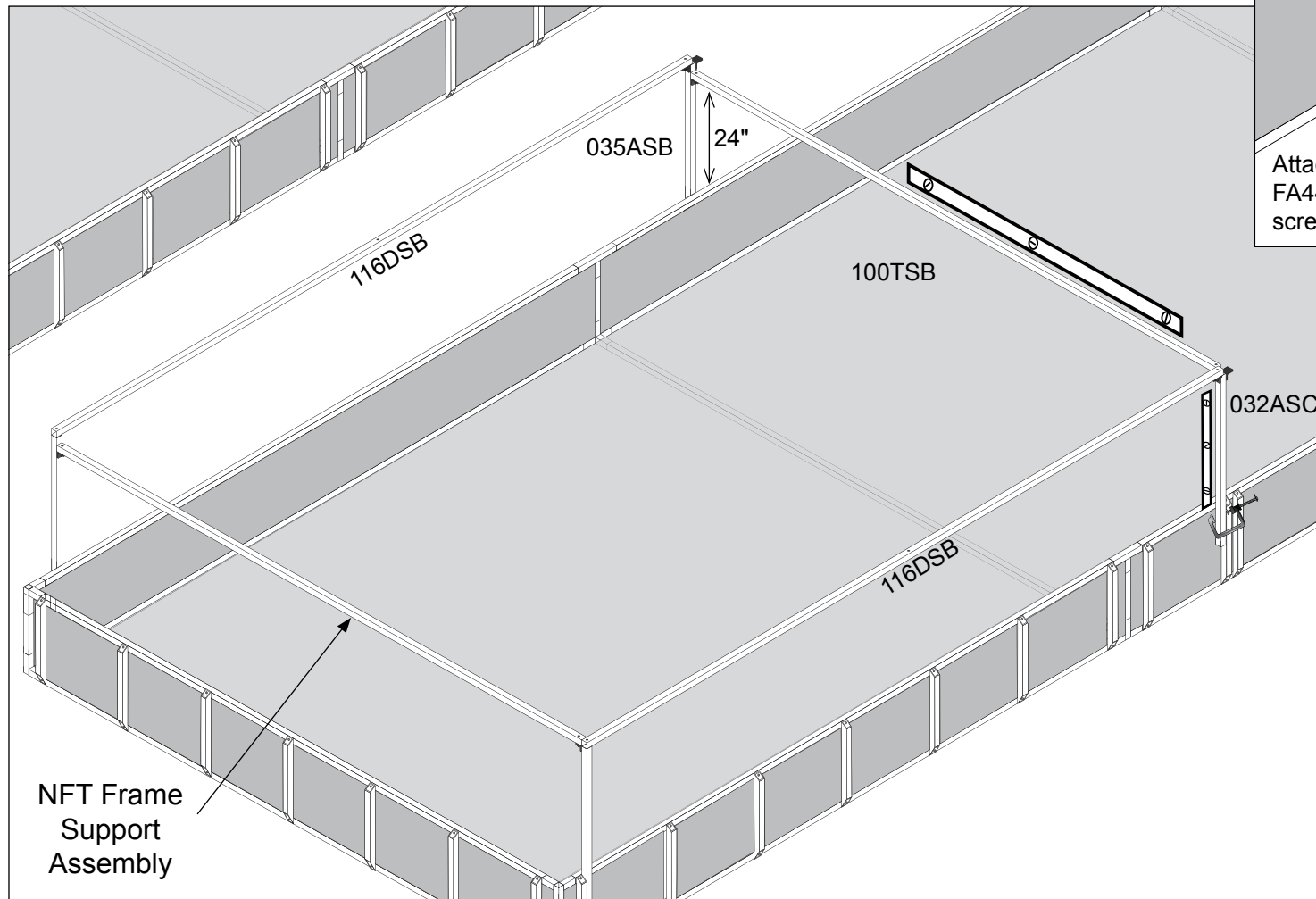
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ATTENTION: Additional beveled raft bed supports are included for installation and to attach the NFT system frame to the raft bed. In some instances leg position may require removal and reinstallation of original beveled support.

If original beveled support is near the NFT system frame leg, it can be used as a support for the leg.

If a few beveled supports remain after both NFT system frames are assembled and installed, attach them to the raft beds for added support.

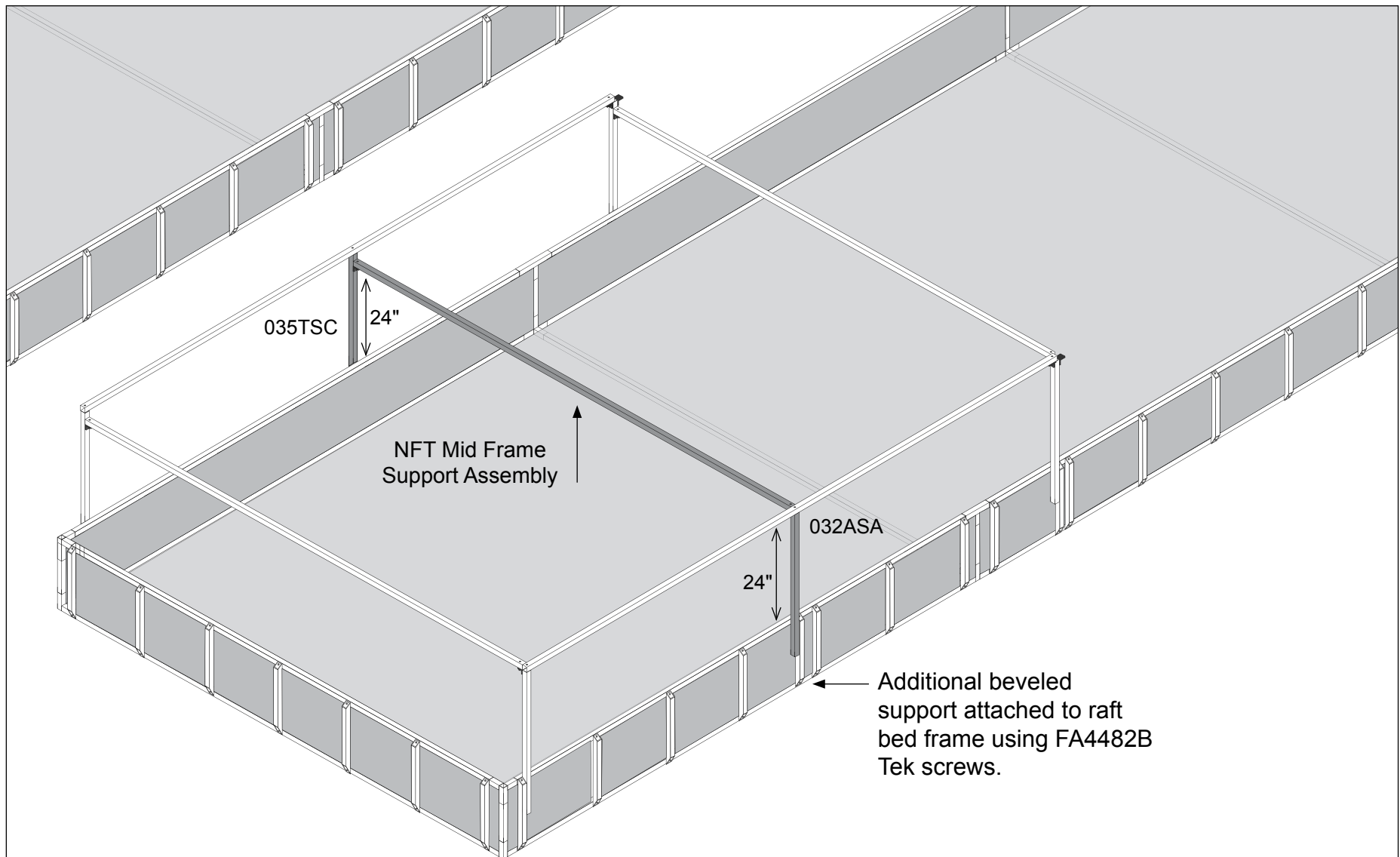


FRAME ASSEMBLY—continued

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9. Once first section of NFT frame is secure, install mid frame supports. Refer to diagrams presented earlier in this section. If needed, install additional beveled supports to attach mid frame vertical tubes to raft bed frame. **Use only the FA4470B Tek screws to attach the beveled supports.** Plumb vertical tubes before attaching these to raft bed frame. Check dimension from top of raft bed to underside of mid frame tube.

ATTENTION: Recheck all fasteners for this first NFT frame section to verify these are tight. Use a level to ensure all vertical tubes are plumb and all horizontal tubes are level.

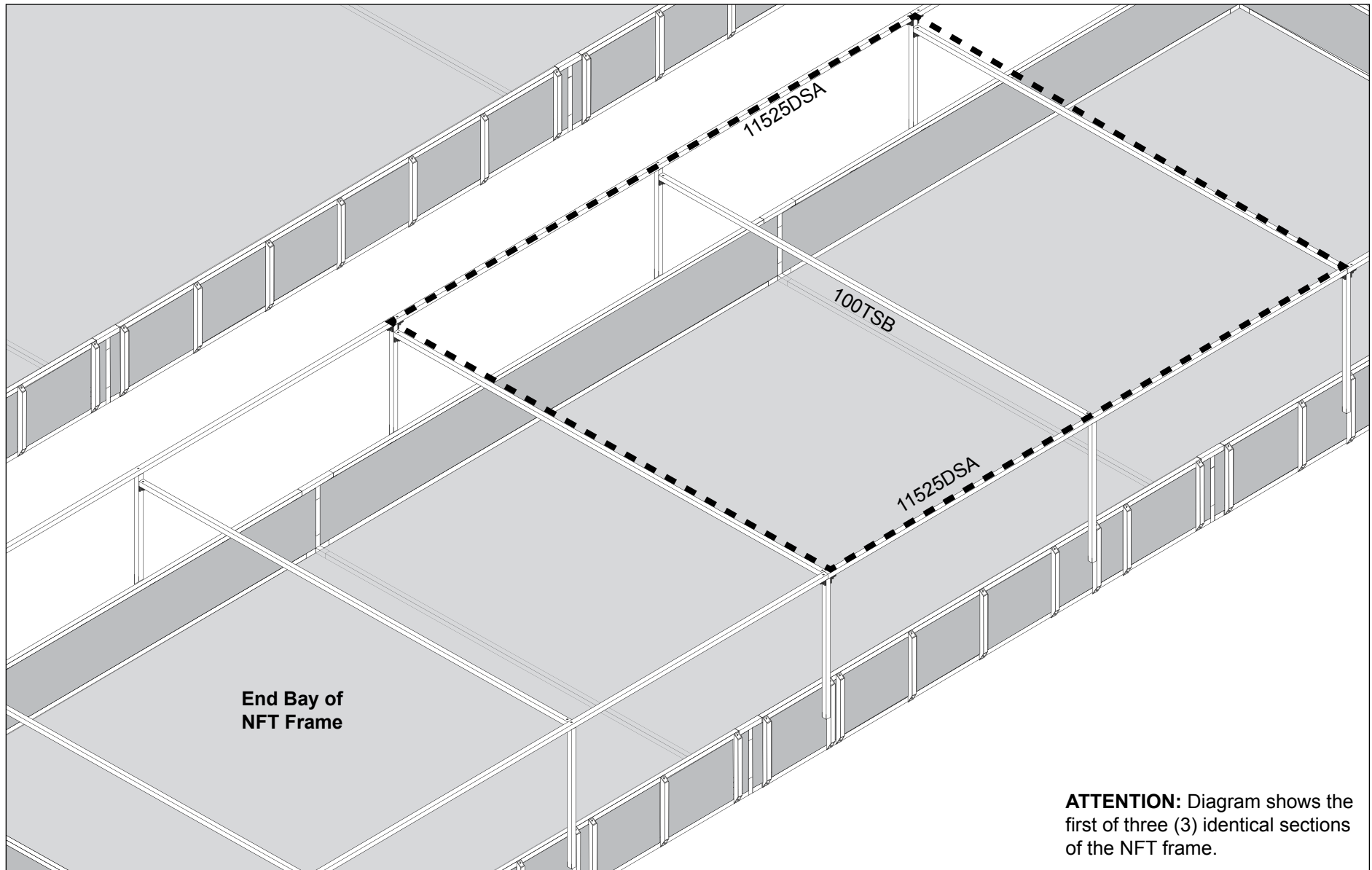


FRAME ASSEMBLY—continued

COLOR CODE: GRAY

10. Continue constructing the NFT frame in square sections and work toward the other end of raft bed.

ATTENTION: The next three (3) frame sections are identical and use 115 -1/4" tubes (NFTS15P11525DSA). The last square section is constructed using 108-1/2" tubes. Install additional beveled supports as needed to secure vertical tubes to raft bed.

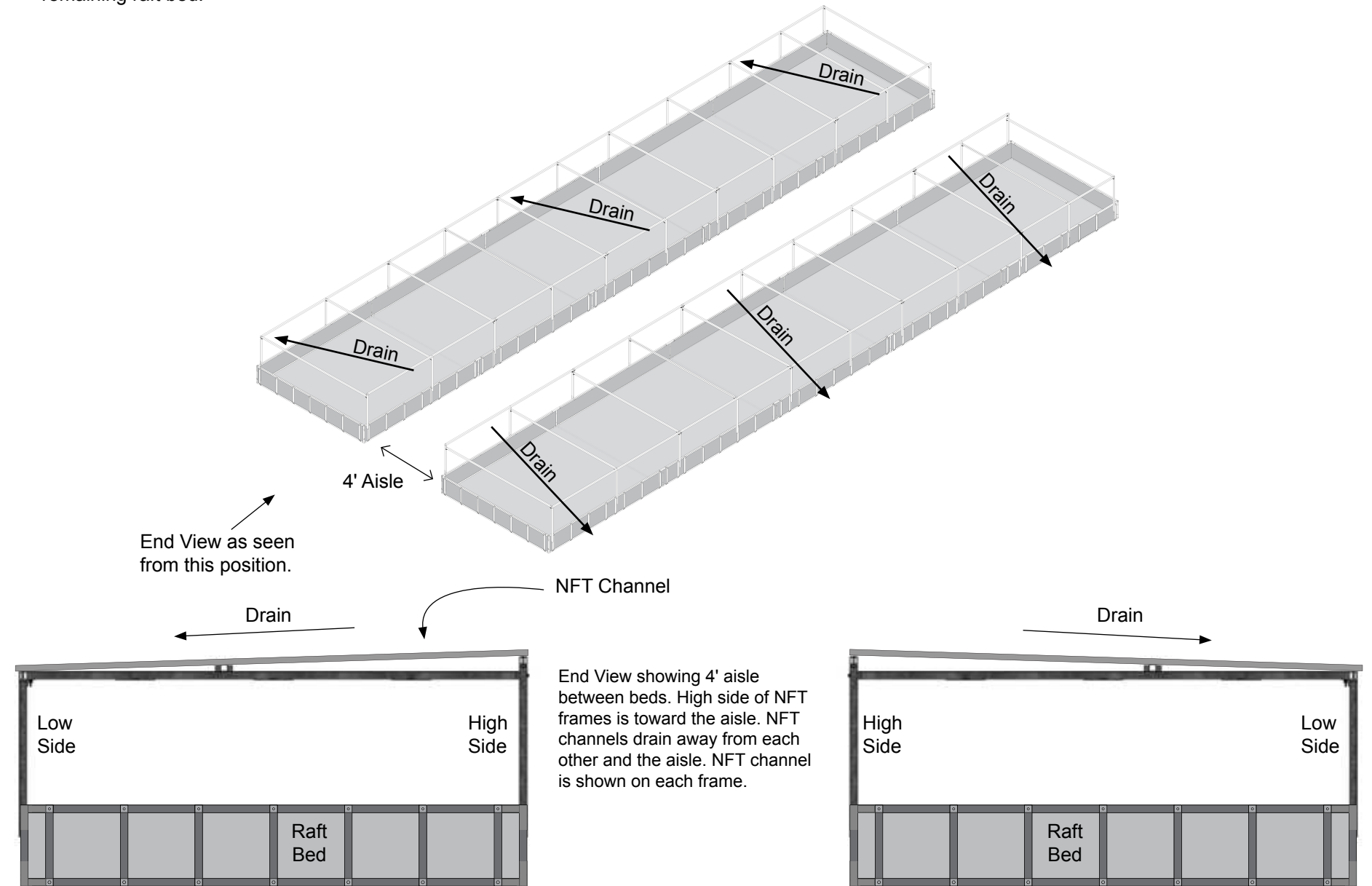


ATTENTION: Diagram shows the first of three (3) identical sections of the NFT frame.

FRAME ASSEMBLY—continued

COLOR CODE: GRAY

11. Repeat frame assembly steps to assemble and install the NFT frame over remaining raft bed.

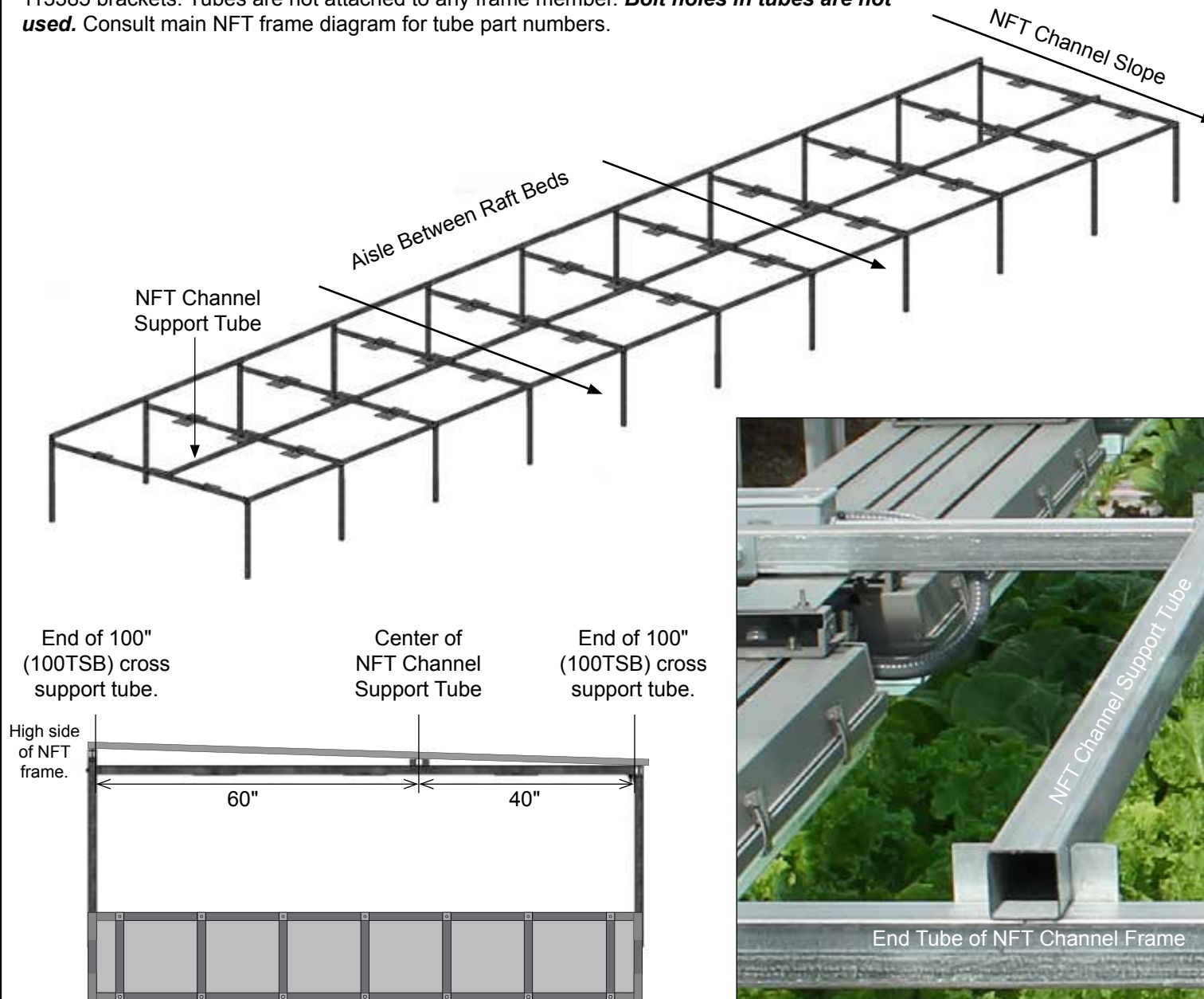


12. After assembling both NFT frames, continue by installing channel support tubes.

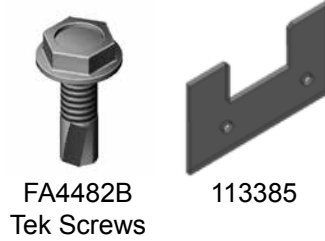
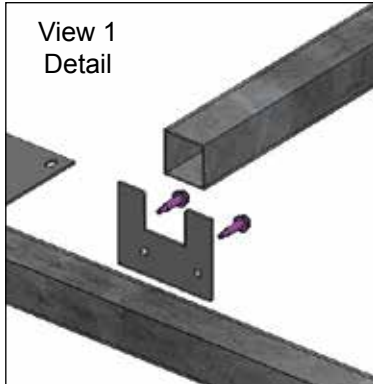
NFT System – Frame Assembly

The NFT Channel Support Tube runs the entire frame length and is locked in position using 113385 brackets and FA4482B Tek screws. Using the dimensions and detail diagrams below and on next page, install the support tube. Support tube assembly is secured using only the 113385 brackets. Tubes are not attached to any frame member. **Bolt holes in tubes are not used.** Consult main NFT frame diagram for tube part numbers.

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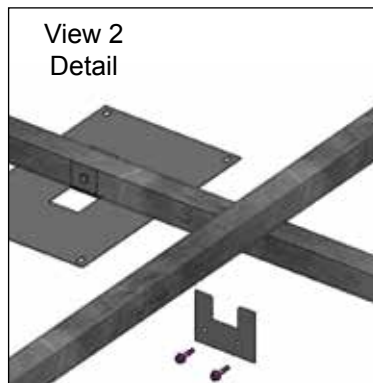
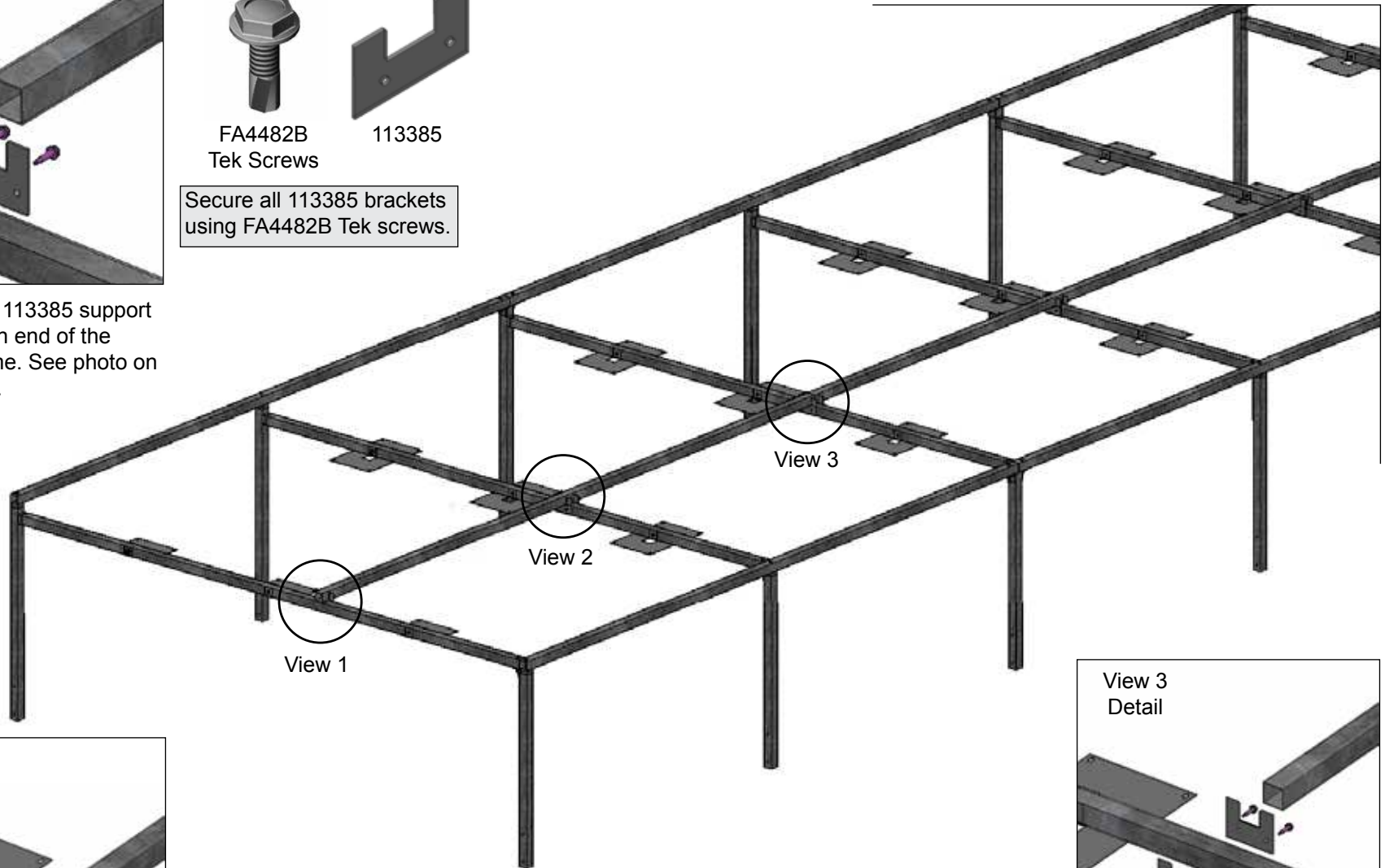


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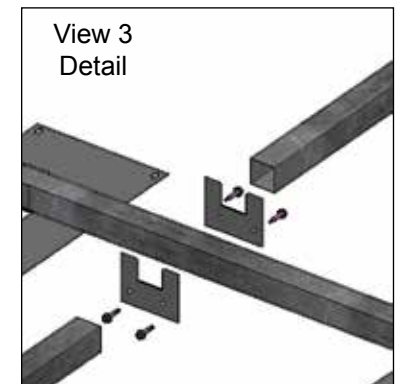


Secure all 113385 brackets using FA4482B Tek screws.

Attach one (1) 113385 support bracket at each end of the main NFT frame. See photo on previous page.



Attach one (1) 113385 support bracket at each mid point of the support tube.



Install two (2) 113385 support brackets where two (2) support tubes meet.

FRAME ASSEMBLY—continued

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Complete these steps:

1. Attach light brackets (113383 & 113384) to the NFTS15P100TSB cross supports as shown below. Tighten bolts until snug. As these are installed, an assistant can begin light fixture installation as shown on the next pages if desired.
2. Continue by attaching all light fixtures to the light brackets.

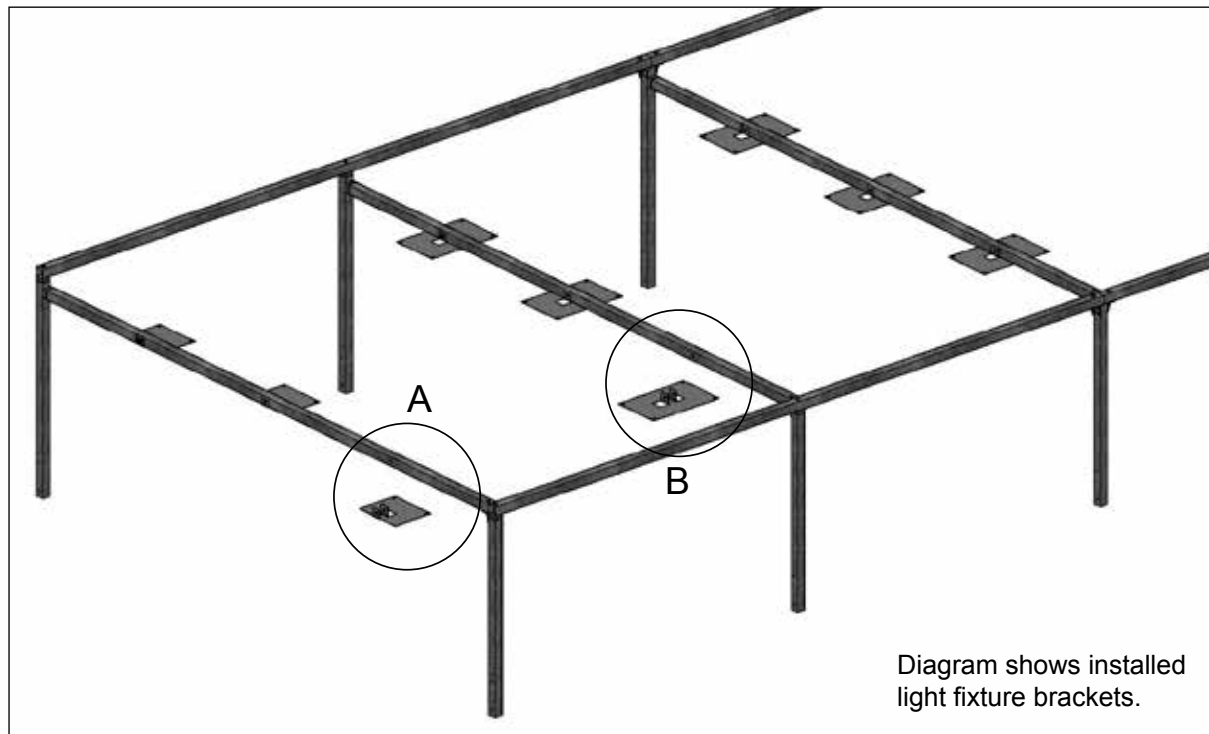
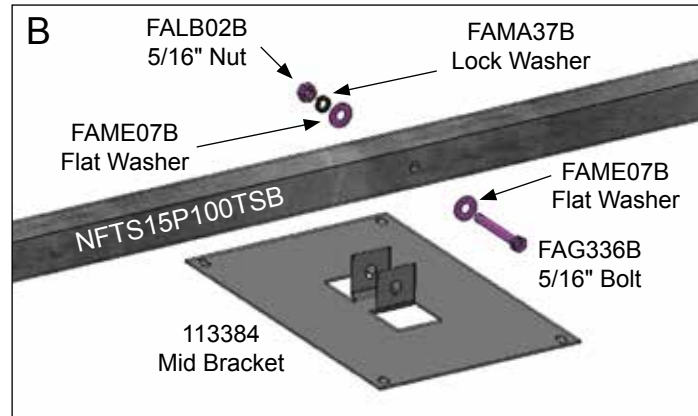
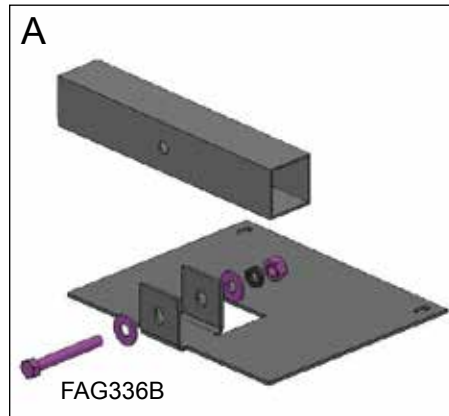
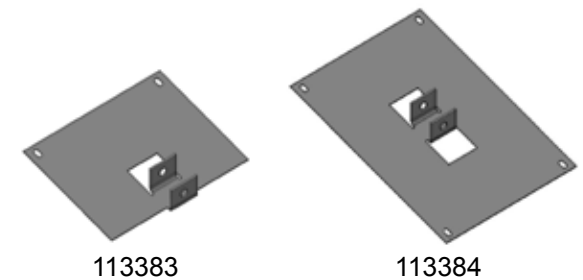


Diagram shows installed light fixture brackets.



ATTENTION: Cover raft bed and liner to prevent liner damage during this procedure. Raft bed is not shown.

FRAME ASSEMBLY—continued

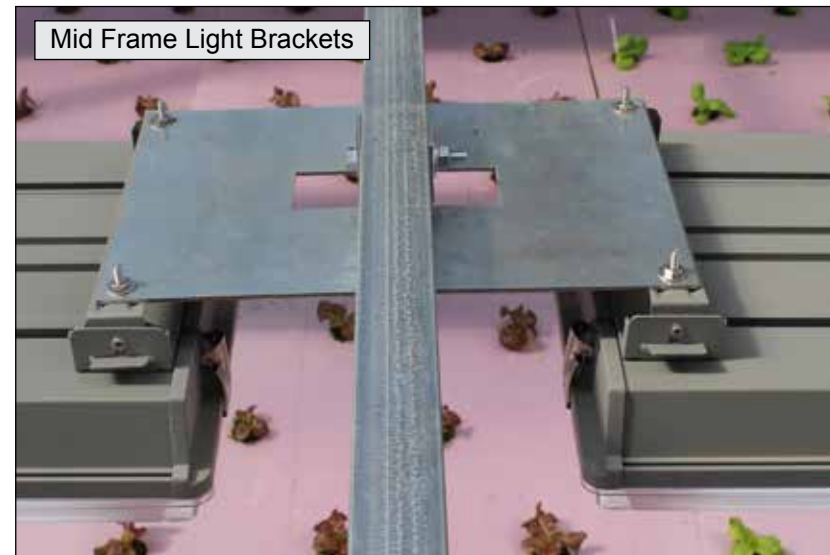
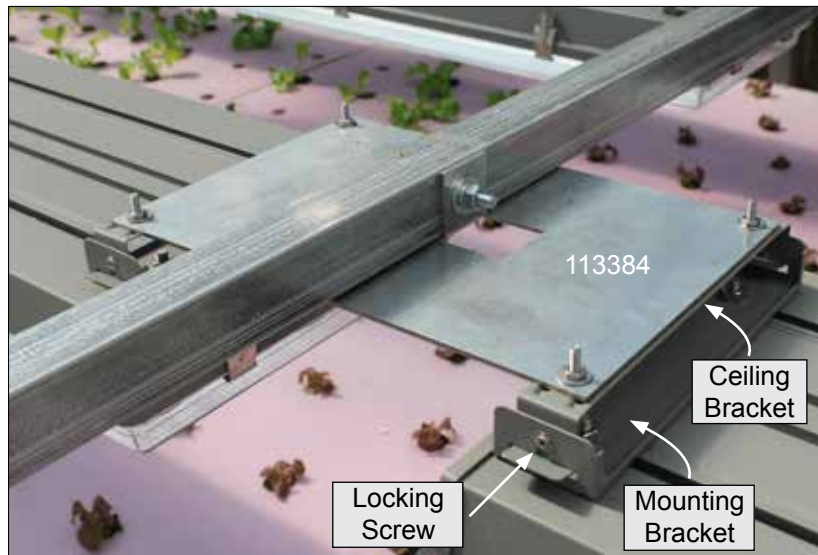
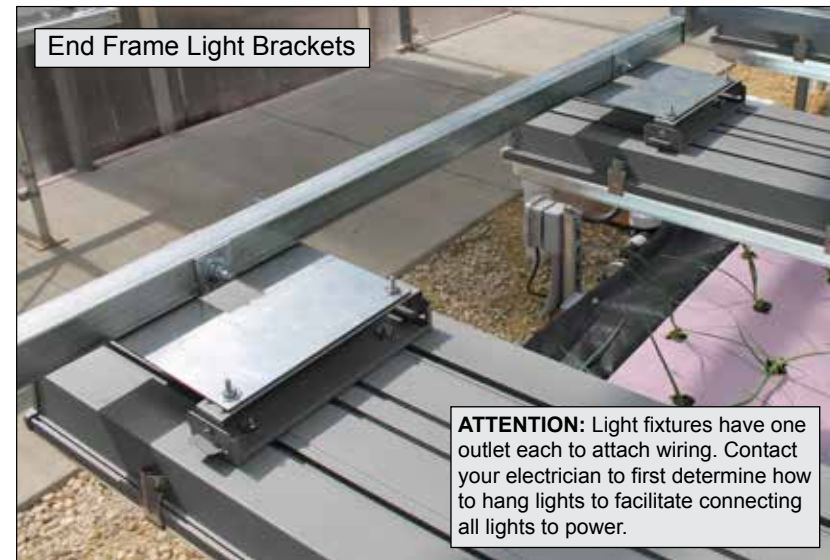
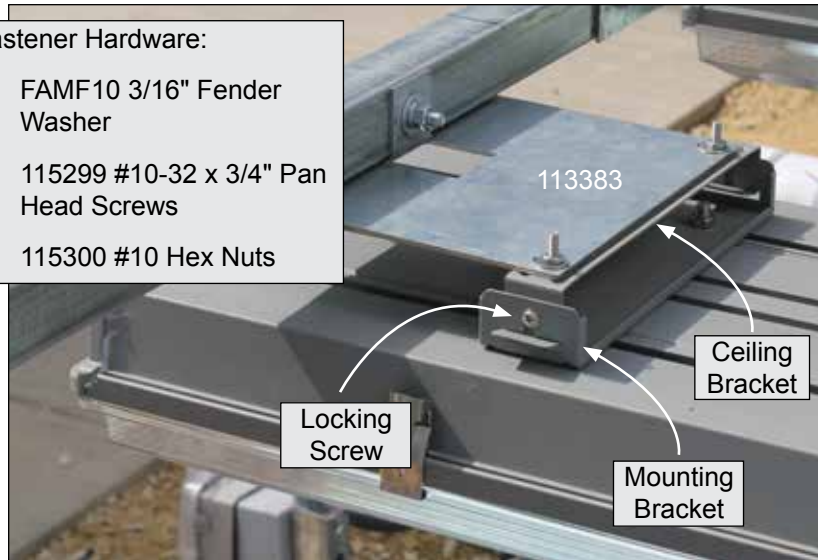
COLOR CODE: GRAY

Complete these steps:

1. Gather hardware noted below and attach ceiling brackets (included with light fixture) to light bracket (113383 or 113384) attached to NFT frame.

Fastener Hardware:

- FAMF10 3/16" Fender Washer
- 115299 #10-32 x 3/4" Pan Head Screws
- 115300 #10 Hex Nuts



2. Attach mounting brackets (included with fixture) to the fixture.
3. With assistance, hang light fixture and secure with locking screw included with light kit.

FRAME ASSEMBLY—continued

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4. Repeat steps to attach all remaining light fixtures to first NFT frame.
5. Repeat process to install light brackets and attach fixtures for remaining NFT frame.



6. After all fixtures are attached, enlist the services of an experienced electrician to connect power to all lights.

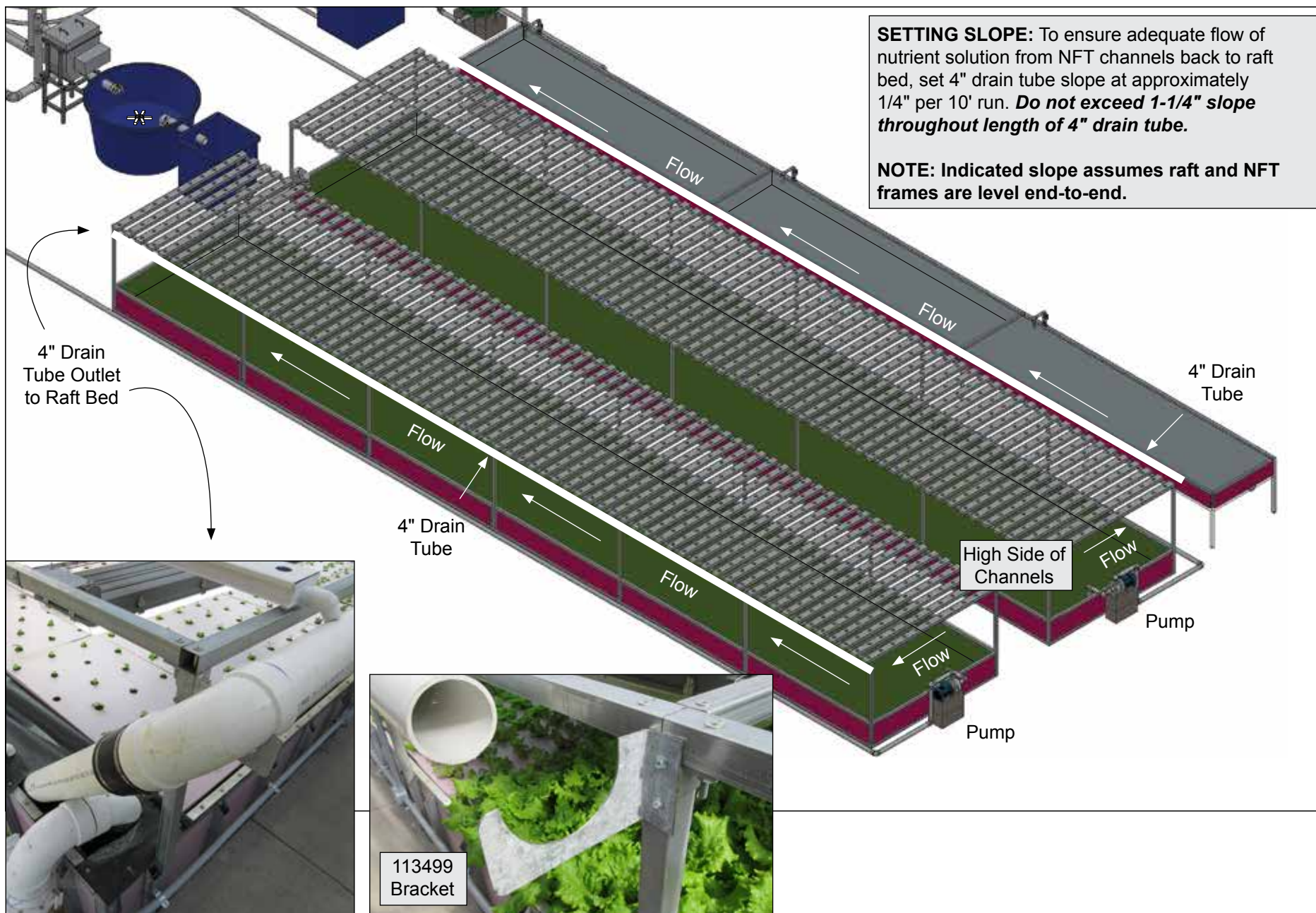
ATTENTION: All wiring to be completed according to established codes and practices.

7. Continue with the next procedure.

NFT System – Drain Tube

Each NFT system drain tube runs along the low side of each NFT frame. Install drain tube brackets and assemble drain tube as shown in this procedure.

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DRAIN TUBE

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Complete these steps:

1. Beginning 1/4" down from top of NFT frame tube at pump end of system, attach the first 113499 4" drain tube bracket to frame leg at low side of NFT frame. Secure using two FA4482B Tek screws for each bracket.

ATTENTION: Install brackets so drain tube slopes toward drain end of tube, which is opposite raft bed water pump. See note on previous page.



2. Move to opposite end of frame and install another 113499 bracket to frame leg. Position bracket top flush with top of NFT leg tube as shown above right.
3. Stretch a string line from top of first bracket to top of last bracket to mark remaining bracket positions. Ensure string is tight and does not sag.
4. Using string line as a guide, attach a 113499 bracket to each leg tube between the two legs at each end of the NFT frame. Top of each bracket should touch the string to maintain proper slope. Total number of brackets for one drain tube is eleven (11), which includes the two end brackets.

DRAIN TUBE—continued

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- Next, construct the 4" drain tube using the WF4171 PVC pipe and 4" couplers. Secure each pipe joint using PVC primer and PVC cement. Apply according to instructions noted on containers. Allow cement to dry before moving if drain tube was not assembled in the installed brackets.

ATTENTION: For appearance and to help mark and align drain holes for all NFT channels, align the printing on each 10' section of 4" PVC tubing during assembly of drain tube.

- With assistance, lift drain tube assembly and place into the 113499 brackets attached to NFT frame legs. Position so tube extends 4"- 6" past bracket at *pump/high end of drain tube*.
- Install the 4" clean-out fitting and clean-out plug and allow adhesive to dry. See photo.



- Continue with the next procedure.

NFT System – Drain Tube

DRAIN TUBE—continued

Each NFT frame supports 68 NFT channels, which all drain into the 4" PVC drain tube constructed earlier. This procedure describes spacing and drilling drain holes in the 4" drain tube.

Required tools (customer-supplied):

- Drill (battery-powered)
- 3/8" hole saw bit or step bit (recommended)
- Tape measure and marker
- Chalk line with non-permanent chalk.

4" Drain Tube Specifications:

- Drain hole diameter: 3/8".
- Drain hole spacing: 8-3/8" on-center.
- Number of 3/8" holes for one NFT frame: 68.

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Step Bit recommended



Photo shows using a step bit to drill holes in the pvc pipe.



Photo shows using a hole saw bit to drill holes in pvc pipe. PVC tube differs from actual 4" drain tube.



Photo below shows an example of a finished drain tube with NFT channels installed. Actual spacing and channels may differ.

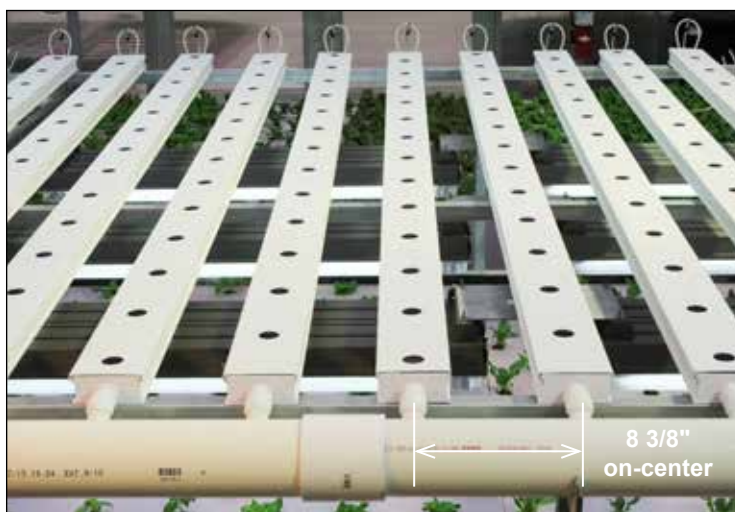


ATTENTION: Spacing NFT channels can vary depending on growing requirements. This procedure describes spacing channels evenly across the NFT frames. Specific growing needs may require alternative spacing.

Photo above shows a working NFT system above the raft bed.

Photo at right shows a 4" drain tube with equally spaced NFT channels installed.

Actual system and channel spacing may differ. Used as an example only.

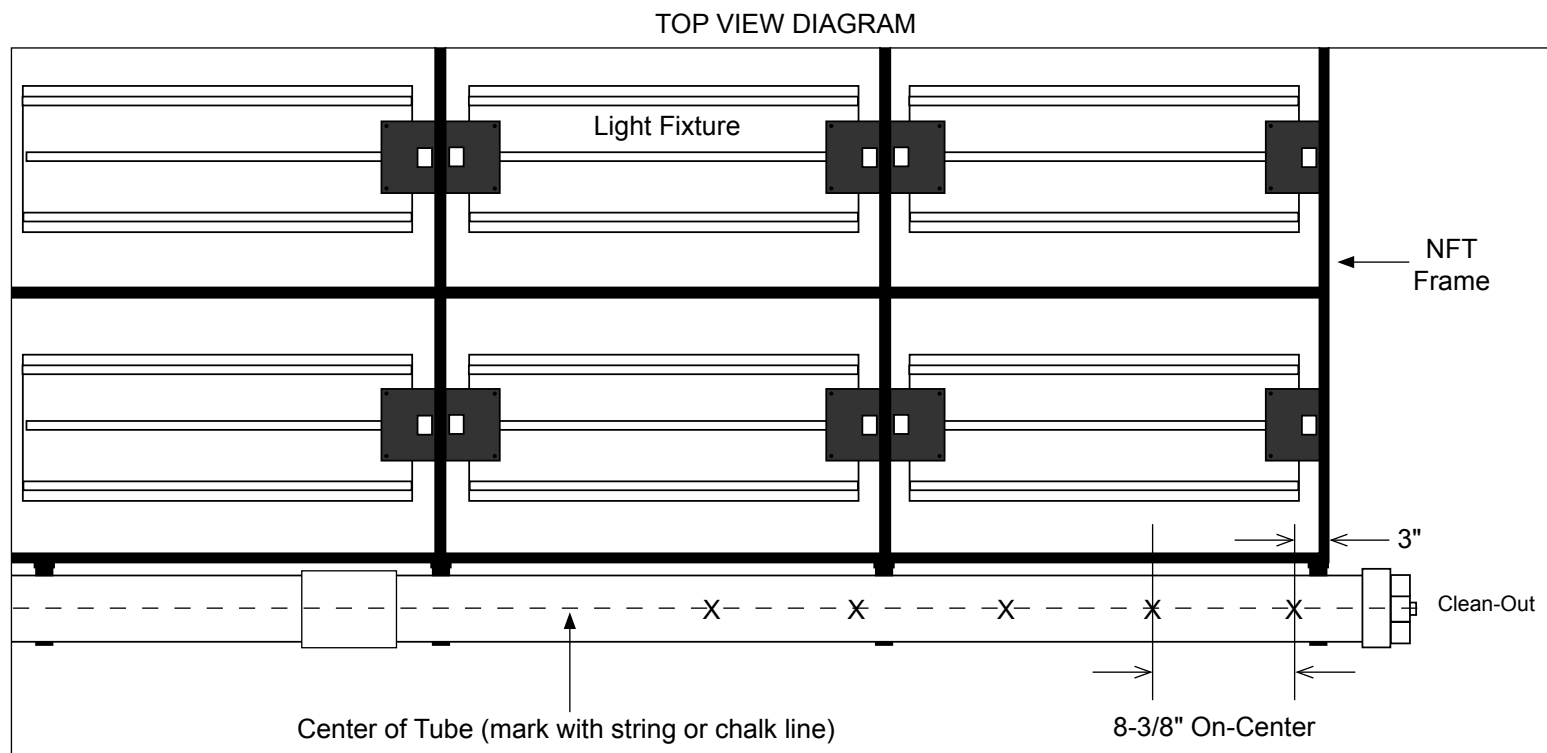


DRAIN TUBE—continued

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Complete these steps to prepare the 4" drain tube for one NFT frame:

1. At the cleanout end of the 4" drain tube, measure 3" in from outside edge of NFT frame and mark center of first 3/8" drain hole.



2. Rotate drain tube if needed to position mark on top of tube. Take a string line or chalk line and mark tube center throughout length of tube. When using a string line, apply small pieces of tape every 10' or so to keep the string line centered on the tube.
3. Beginning *at the first mark (Step 1)*, measure 8-3/8" to mark the next drain hole position. Use the string or chalk line as a guide.
4. Continue marking the 8-3/8" on-center hole positions along the drain tube until all 68 drain hole positions are marked.

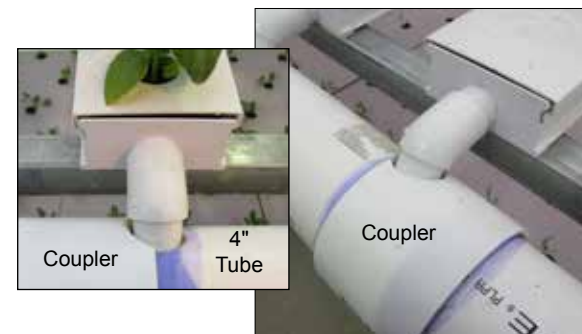
ATTENTION: There will be extra space on the frame at the drain end of the 4" drain tube to allow for installation of remaining 4" elbow and fittings to complete the 4" drain.



DRAIN TUBE—continued

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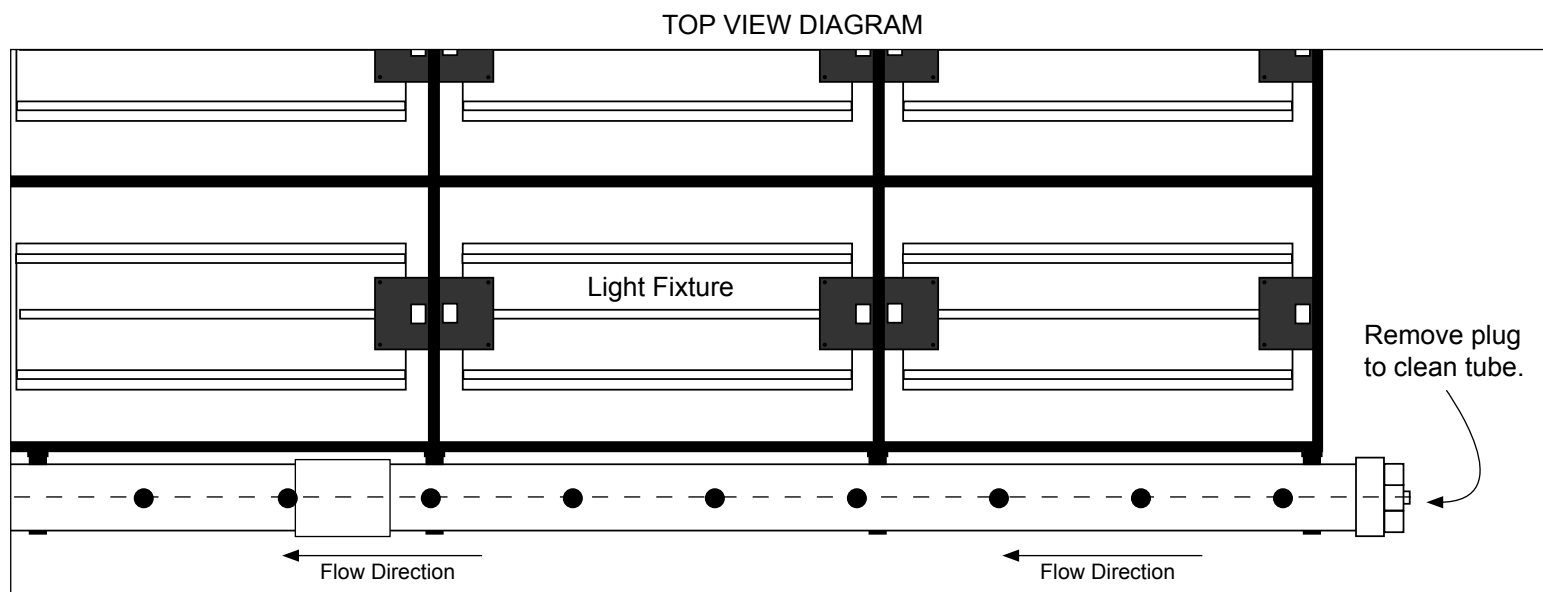
5. Check alignment to ensure hole positions are centered and evenly spaced. Minor variances are acceptable.
6. Using a 3/8" hole saw bit (step bit (shown) is recommended) and a drill, carefully drill a hole at each mark. *There are 68 holes in all for one 4" drain tube.*



ATTENTION: In some instances, an on-center mark may require drilling a through a 4" PVC coupler. If position is on coupler edge, adjust as needed for easier drilling if desired. Drill through coupler if hole position allows. If even spacing is the desired result, drill where indicated by on-center marks.

7. Remove drain clean-out plug and clean drain tube to remove all PVC debris from around each drain hole and from inside drain tube.

NOTE: Debris will clog filters, valves, and nutrient tubes if tube is not cleaned before system is tested.



8. Continue by constructing and drilling the remaining 4" drain tube for the other NFT frame.

NFT CHANNELS

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Assemble the NFT channels on the NFT frames for best results. After assembly, allow adhesive to set before moving. Use the information that follows to assemble all NFT channels.

Required parts:

- 110763Z104: 8'-8" L HYDROCYCLE 4" PRO NFT CHANNELS
- 112835Z104: 8'-8" L HYDROCYCLE 4" PRO LIDS W/1.375" HOLES
- 110824: HYDROCYCLE 4" PRO NFT END CAPS W/OUTLET
- 110825: HYDROCYCLE 4" PRO NFT CHANNEL END CAPS
- 111045: 1" 45 DEGREE STREET ELBOWS

Required tools (customer-supplied):

- Drill (battery-powered) and 9/32" or 5/16" drill bit
- CA4000 Instant Adhesive (included)

Photo below shows assembled NFT channels without lids installed. Drain tube is not shown.



NFT CHANNELS — continued

ATTENTION: Attach one 110824 end cap with an outlet and one 110825 plain end cap to each NFT channel. Verify before applying adhesive.



IMPORTANT: Each bottle is sufficient to construct at least five (5) NFT channels. Adjust application quantity as needed so supply is sufficient.

Complete these steps:

1. Using the assembled frame as a bench, place one NFT channel on the NFT frame.
2. Take the CA4000 adhesive and attach the plain end cap (no outlet–110825) to the channel end resting on the high side of the NFT frame. This is the side with the 35" leg tubes. Be sure to coat the channel end with adhesive *before* installing end cap. See photos A & B. Also, apply adhesive to the connection inside the channel. See photo E. Repeat for all NFT channels.
3. At the other end of the channel, install the 110824 end cap (with outlet). Coat channel end with adhesive *before* installing end cap. See photos C & D. Also, apply adhesive to connection inside the channel. See photo E. Repeat for all NFT channels.

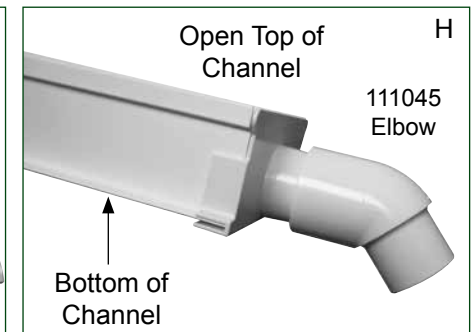
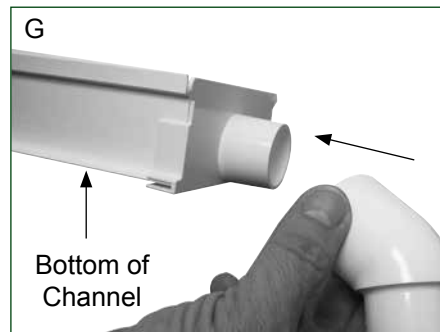
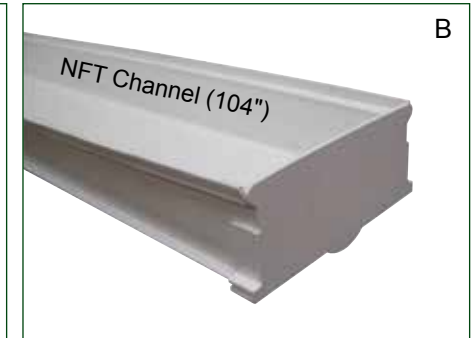


Apply adhesive in a well-ventilated area. Read the container information for additional precautions.

4. Carefully flip all channels over so bottom faces up. Apply adhesive along the edges to secure and seal end caps. Photo F shows an end cap with an outlet. Secure plain end caps in the same manner.

NOTE: Coat all edges and seams of end caps (inside and outside) to prevent leaks.

5. Allow adhesive to dry before moving channels or testing the system.
6. Finally, slide a 45° elbow (111045) onto the end cap. Install fitting with the open end pointing down in the 6:00 o'clock position. See Photos G & H.
7. Repeat to install all elbows.
8. Continue with the next procedure.

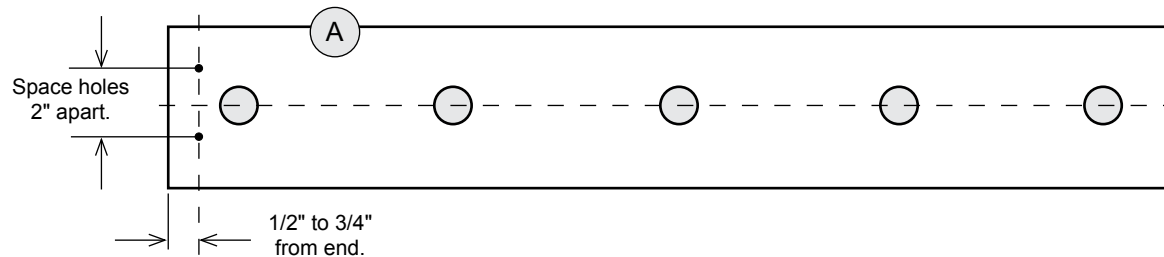


NFT CHANNEL LIDS: DRILL TUBE HOLES

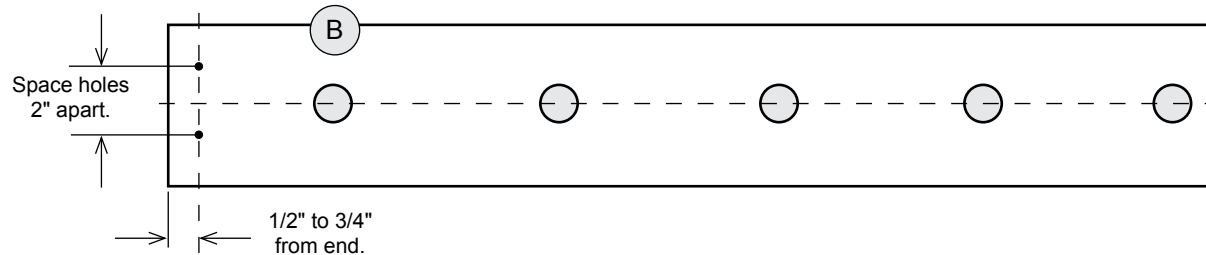
Lids are designed to off-set holes for improved plant growth. During installation, alternate lids as shown. Before snapping lids onto NFT channels, drill the nutrient tube holes at one end of each lid.

Complete these steps to drill holes for nutrient tubes:

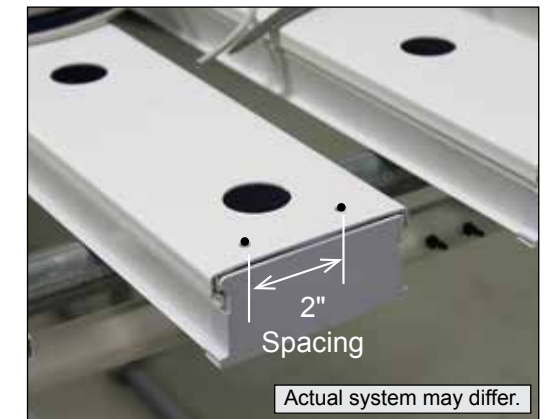
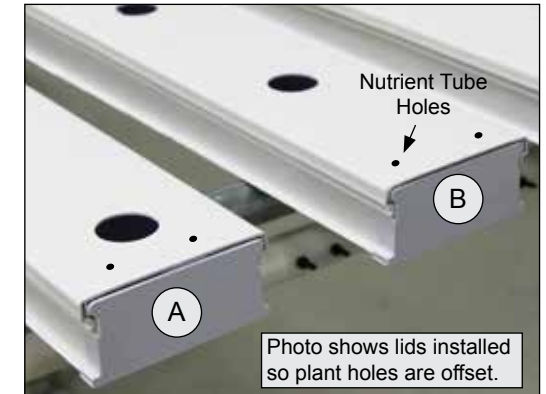
1. Take sixty-eight (68) channel lids (112835Z104) and arrange so all plant holes and ends align. Take the remaining sixty-eight (68) channel lids and repeat this step. Keep the two stacks separate.
2. Once the lids are separated, move to stack A and drill two (2) 9/32" (or 5/16") holes in each lid **where first plant hole is closest to the end**. Keep lids in the same stack when completed. See A in the photo and diagram below.



3. Move to stack B and drill two (2) 9/32" (or 5/16") holes in each lid where first plant hole is **farthest from the end**. Keep these lids together when completed. See B in the photo and diagram.



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ATTENTION: Drill holes away from open channels to prevent debris from dropping into the channels.



NFT CHANNEL LIDS: DRILL TUBE HOLES — continued

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- Next, wipe shavings from each lid (top side and underside).
- Move to the NFT channels and install a lid on each channel. Ensure adhesive has set according to directions on container before moving channels.

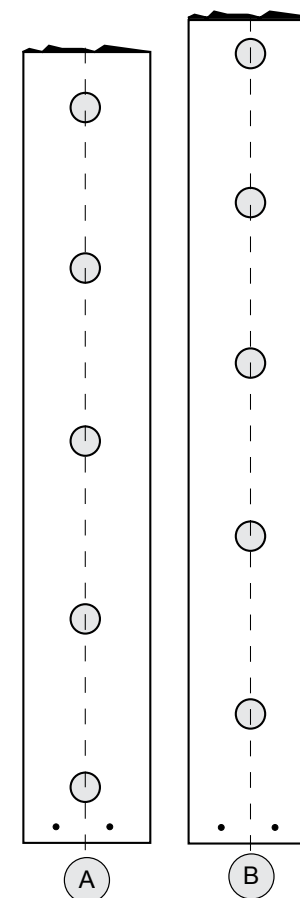
IMPORTANT: *Position all nutrient tube holes in lid opposite the drain elbow on each channel.*

- Set prepared channels in place on each frame as shown below. Space evenly with drain elbows inserted in 4" drain tube.

ATTENTION: Remember to arrange channels so hole positions alternate for best growing environment.



Top View of Channels



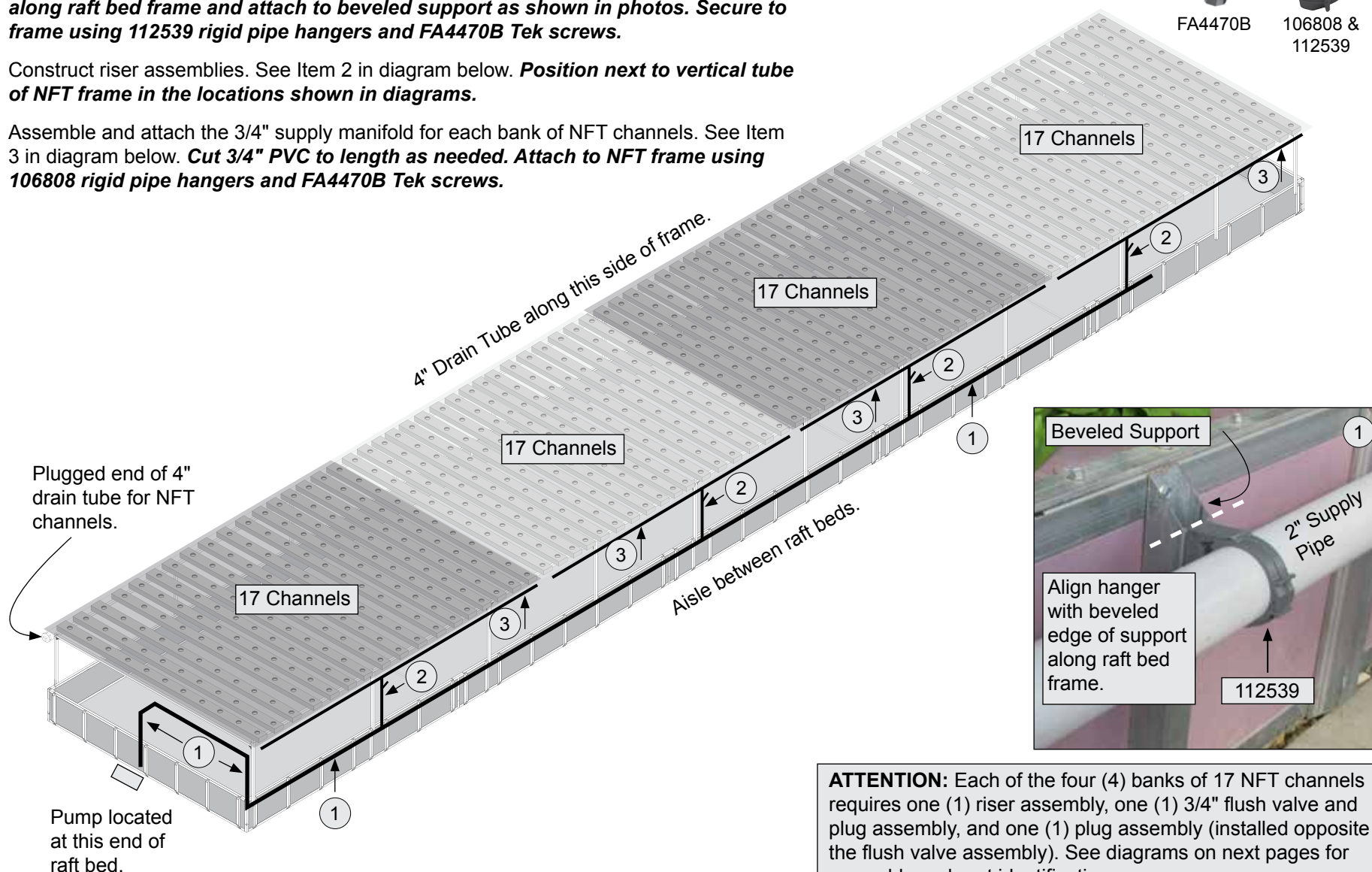
- Continue with the next procedure.

ASSEMBLE NUTRIENT SUPPLY PLUMBING

The nutrient supply plumbing for each NFT frame directs water from the water pump to four (4) riser assemblies. Each riser controls flow to 17 NFT channels. Follow these basic steps to assemble and install the nutrient supply plumbing.

1. Assemble and attach the 2" main supply tube. See Item 1 in diagram below. **Position along raft bed frame and attach to beveled support as shown in photos. Secure to frame using 112539 rigid pipe hangers and FA4470B Tek screws.**
2. Construct riser assemblies. See Item 2 in diagram below. **Position next to vertical tube of NFT frame in the locations shown in diagrams.**
3. Assemble and attach the 3/4" supply manifold for each bank of NFT channels. See Item 3 in diagram below. **Cut 3/4" PVC to length as needed. Attach to NFT frame using 106808 rigid pipe hangers and FA4470B Tek screws.**

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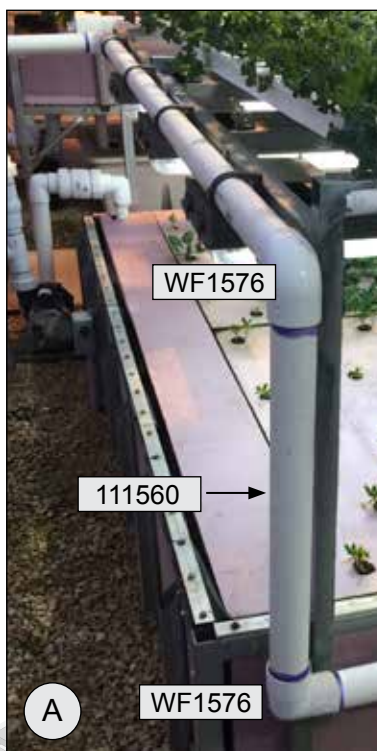
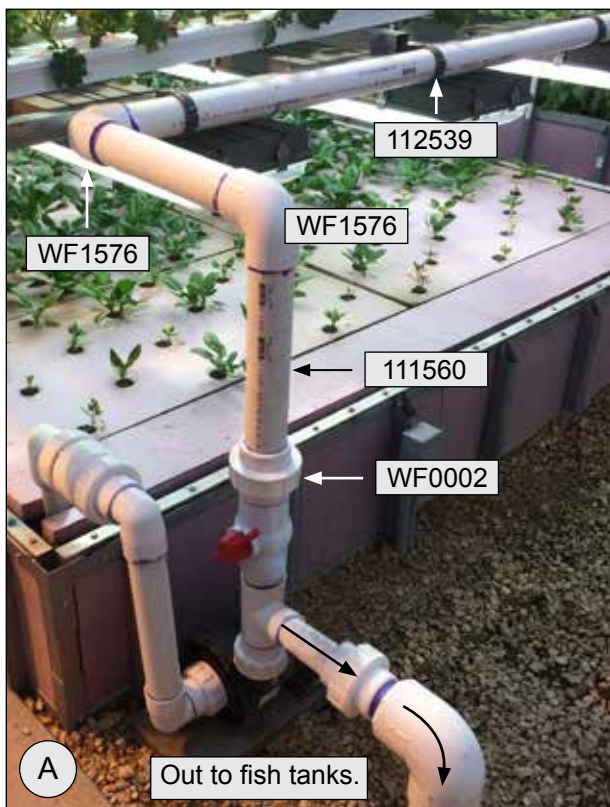


ATTENTION: Each of the four (4) banks of 17 NFT channels requires one (1) riser assembly, one (1) 3/4" flush valve and plug assembly, and one (1) plug assembly (installed opposite the flush valve assembly). See diagrams on next pages for assembly and part identifications.

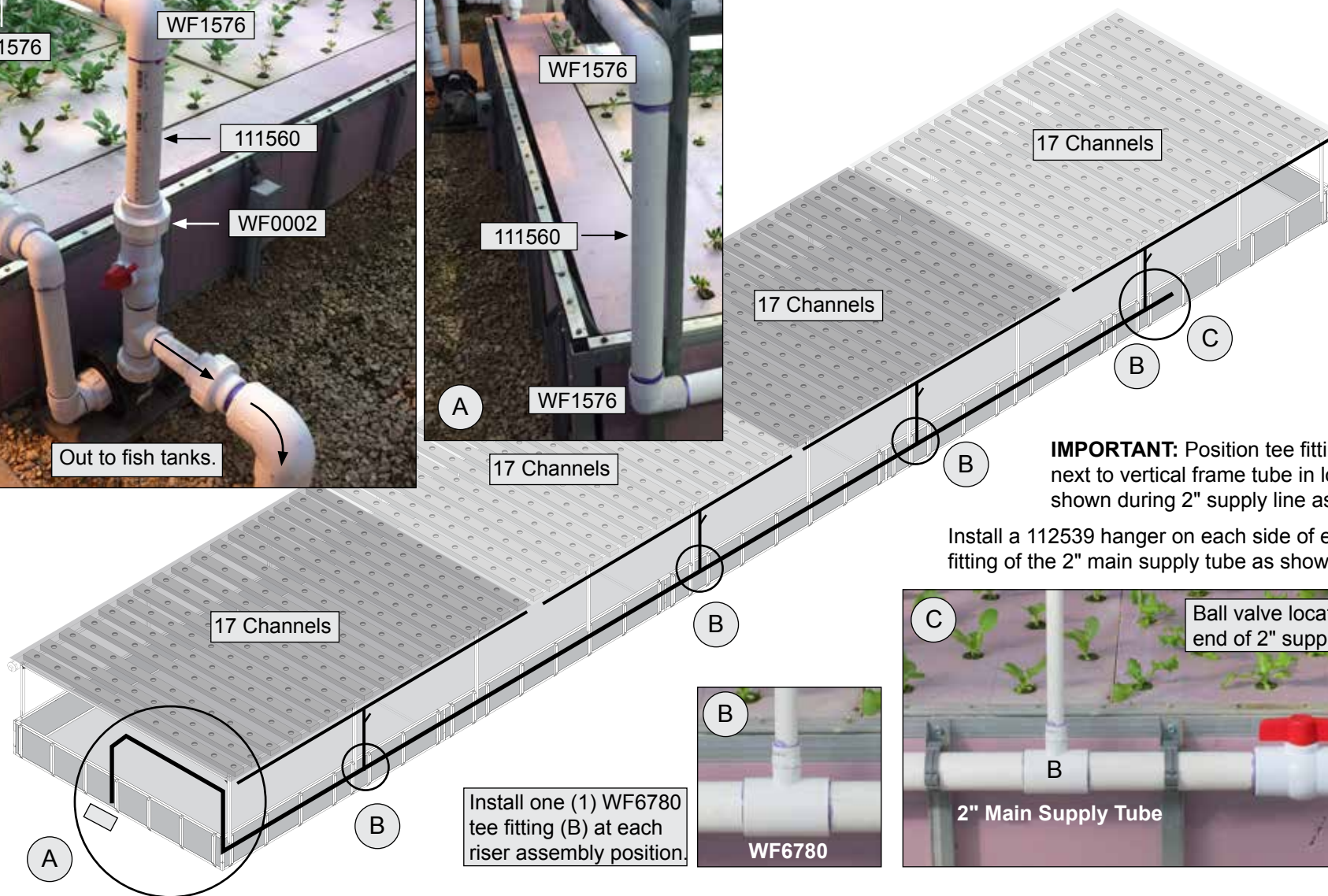
NFT System – Nutrient Supply Manifolds

ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

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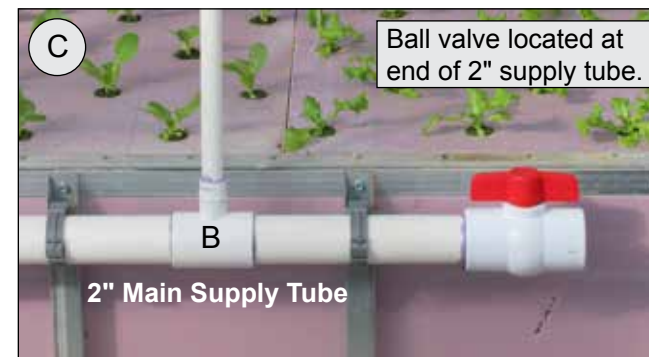
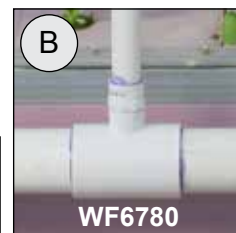


ATTENTION: Actual plumbing layout may differ from what is shown and depends on water pump location. Fittings included with this system allow for connecting the NFT plumbing to the water pump of each raft bed as shown at the left. Altering the layout may yield unused parts, or require additional purchase of parts.



IMPORTANT: Position tee fitting (B) next to vertical frame tube in locations shown during 2" supply line assembly.

Install a 112539 hanger on each side of each tee fitting of the 2" main supply tube as shown.



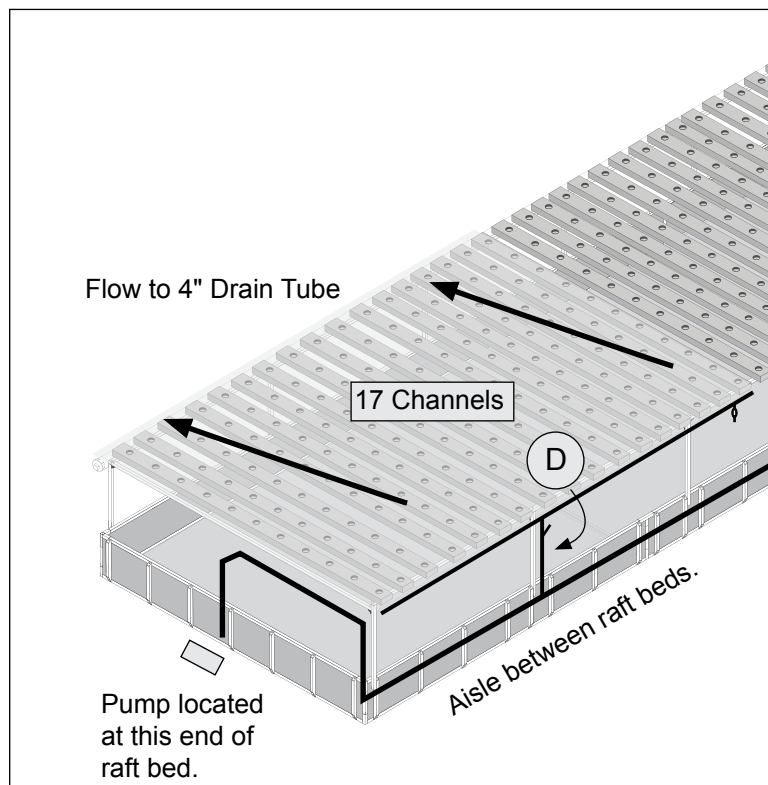
ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

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Complete these steps to construct and install each riser assembly:

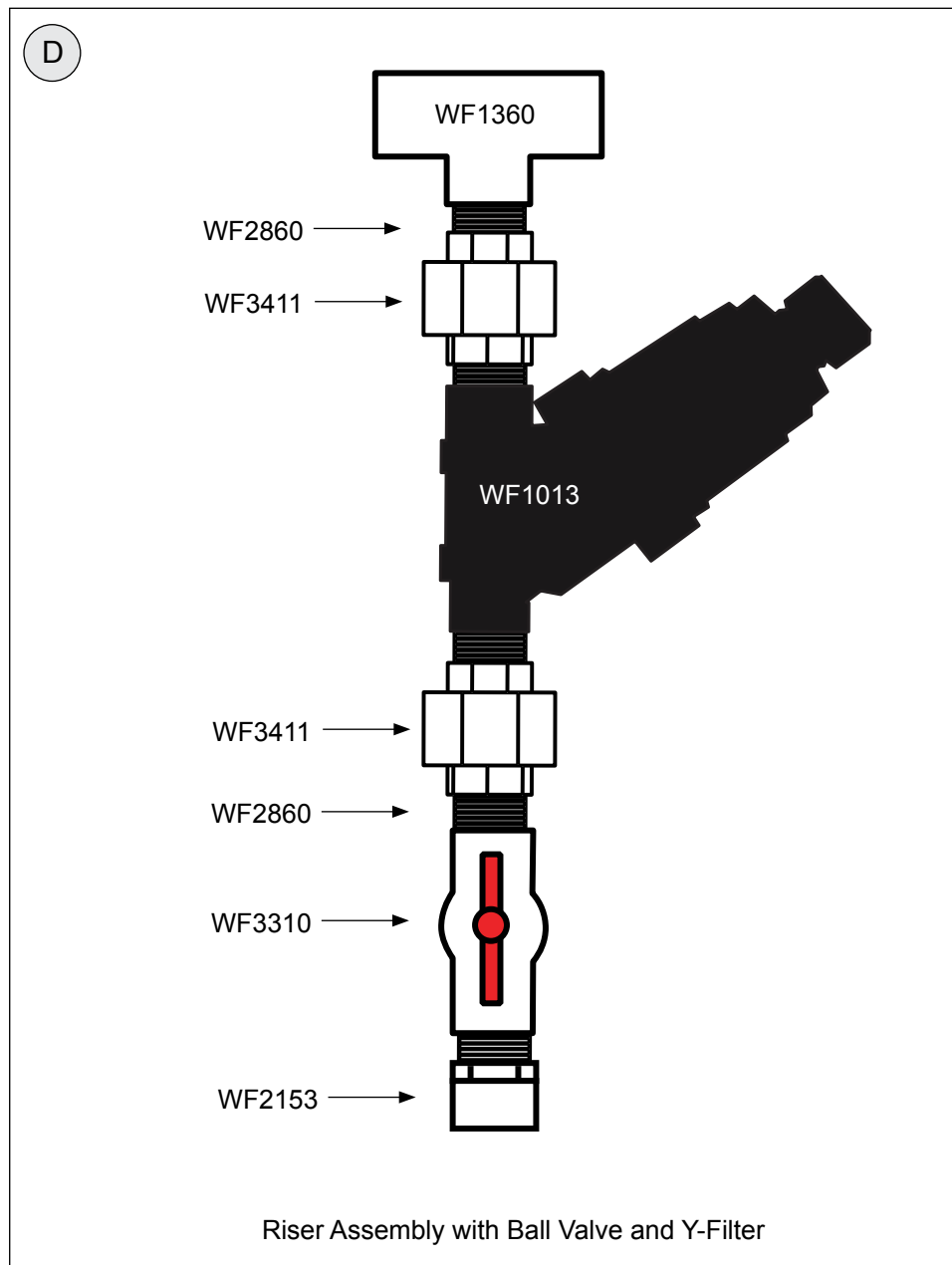
1. Gather the parts shown in Diagram D (right) to construct one (1) riser.
2. Assemble as shown.

NOTE: Wrap threads of all threaded fittings with thread-sealing tape. Wrap in a direction that allows tape to remain in place when fittings are connected.



3. Repeat to assemble three (3) remaining risers for first NFT frame.

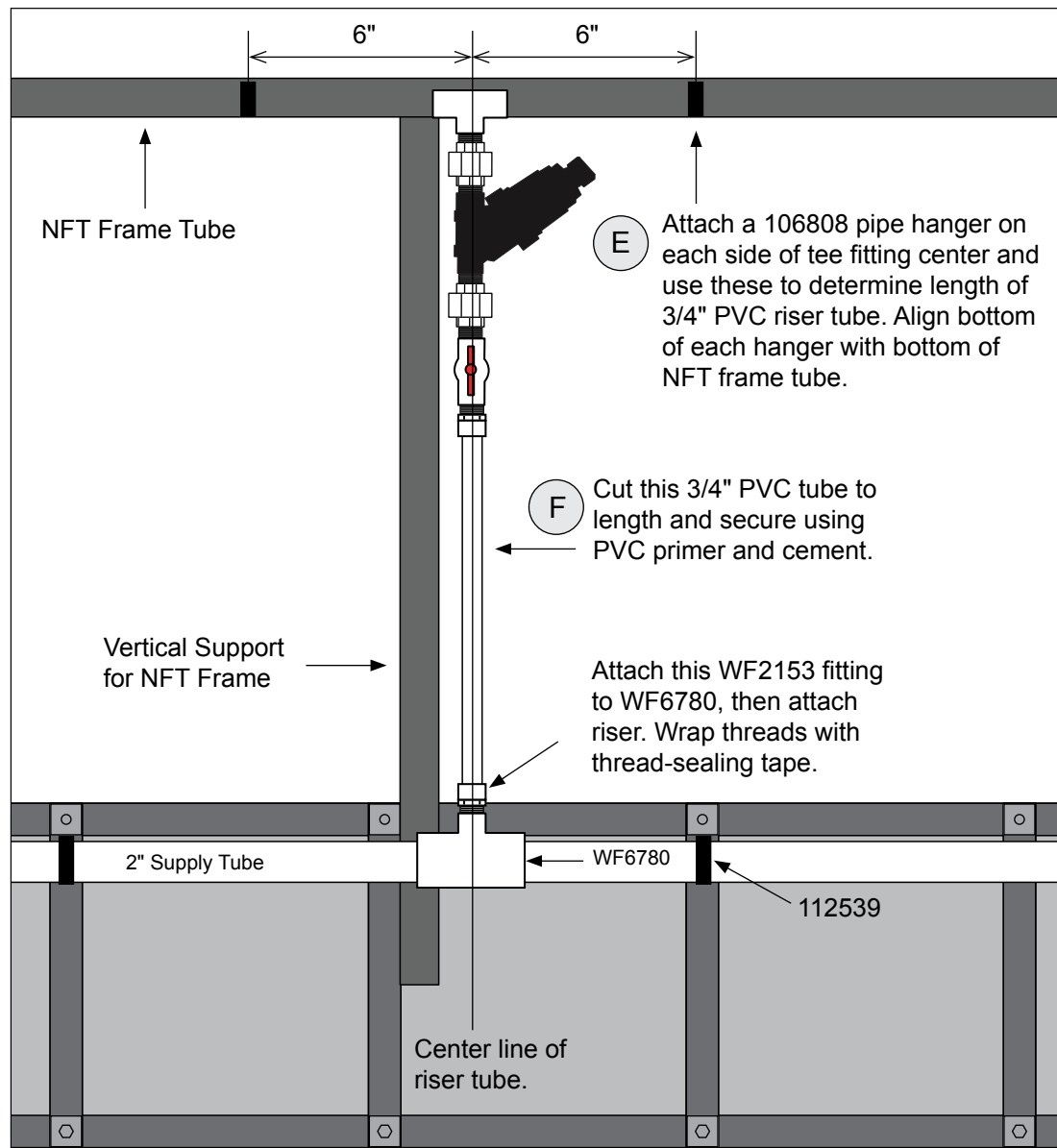
NOTE: Diagram above shows location of first riser (D) when installed. This riser controls flow to the first bank of 17 NFT channels once the 3/4" supply manifold tubes are installed.



ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

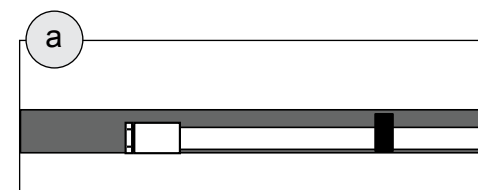
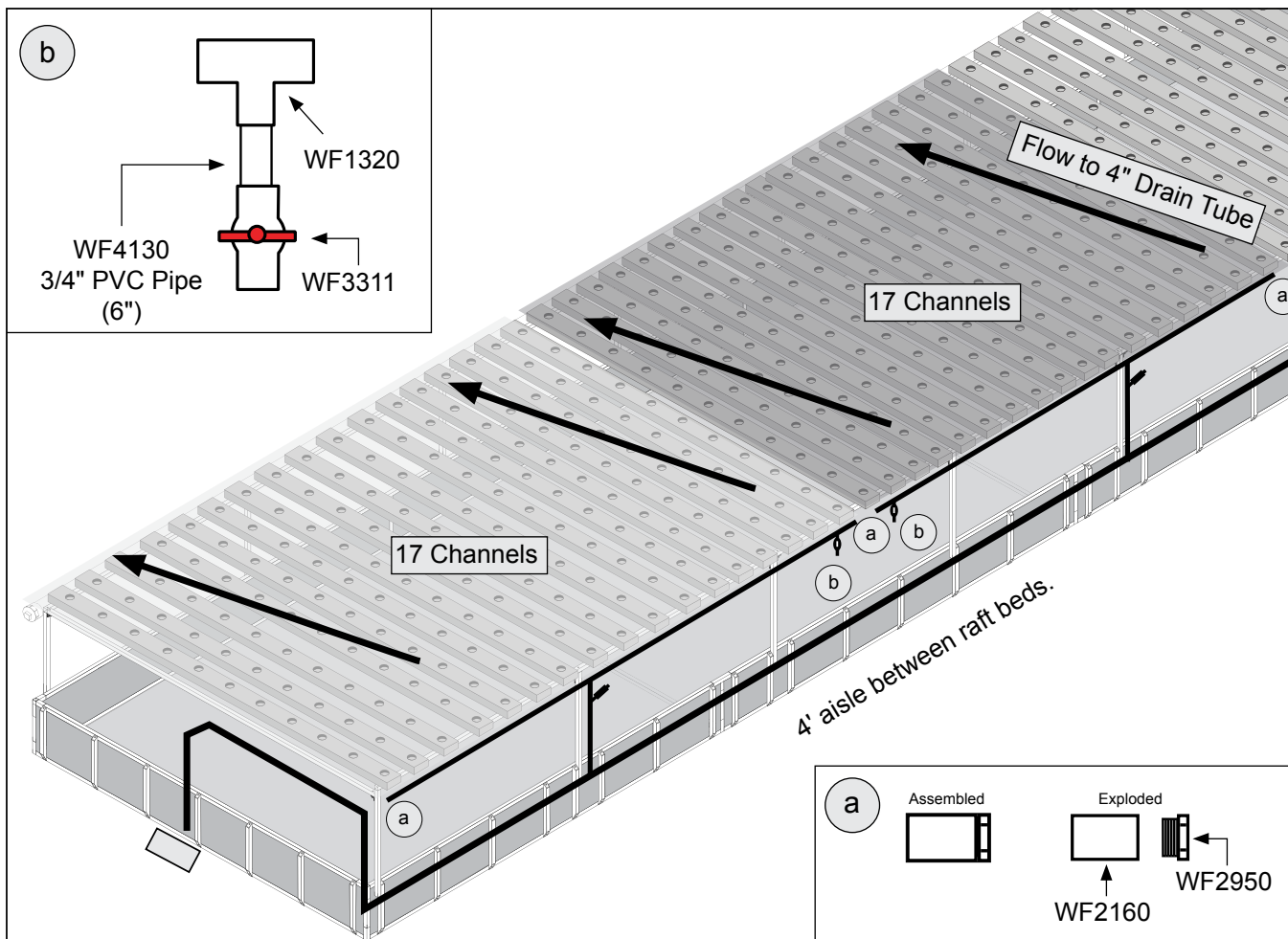
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4. After creating four (4) riser assemblies (previous page) for the first NFT frame, attach one riser assembly to each WF6780 tee fitting of the 2" main supply tube. Use diagram below to install two 106808 pipe hangers (E) and to determine length of 3/4" PVC tube (F) that connects riser to 2" main supply tube. Tee fitting outlets of riser must align with installed 106808 pipe hangers.

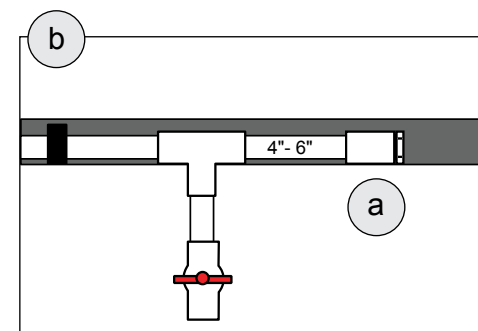


ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

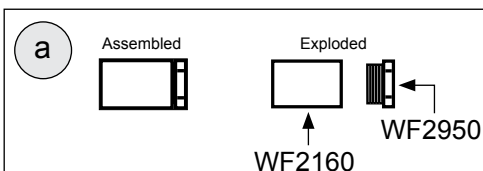
5. After installing risers for first NFT system, construct eight (8) clean-out with plug assemblies (a) and four (4) ball valve drain assemblies (b). See diagrams.
6. Set assemblies aside when complete to allow PVC cement for ball valve drains to dry.
7. Verify channel positions and spacing on NFT frame for first bank of 17 channels. Determine on which end of supply manifold to install clean-out with plug assembly (a) and which end to install the ball valve drain assembly (b). Diagram below shows installing ball valve drain assemblies near each other for easier maintenance of system. *Assemblies can be installed at either end of the supply manifold.*



Clean-Out with Plug
Install at each end of Supply Manifold.

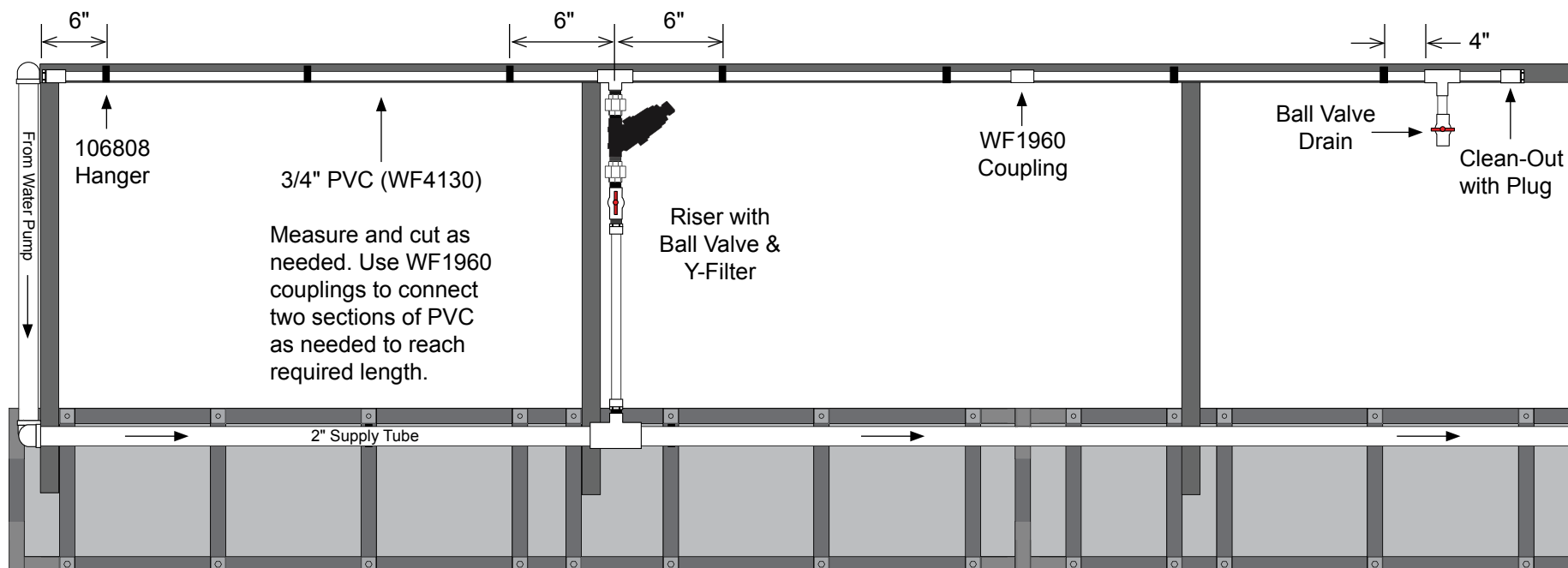


Ball Valve Drain with Clean-Out
Install at desired end of Supply Manifold.



ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

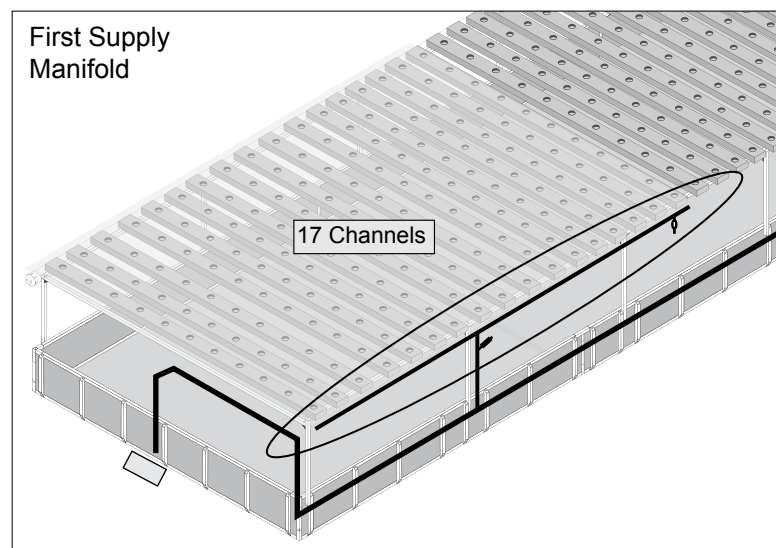
8. Using 3/4" PVC tubing (WF4130), one (1) ball valve drain assembly, and two (2) clean-out with plug assemblies, construct the first supply manifold. Manifold will serve 17 NFT channels. **See diagram (lower-right).**



ATTENTION: Use PVC primer and cement to secure each slip joint during assembly. Follow directions on containers.

9. Use seven (7) 106808 3/4" pipe hangers to secure the first supply manifold to frame. Install as shown in diagrams above. Evenly space the remainder at approximately 24" - 36" on-center.

ATTENTION: Do not exceed seven (7) 106808 pipe hangers to secure one supply manifold. Some manifolds may require fewer hangers depending on placement of riser assembly.

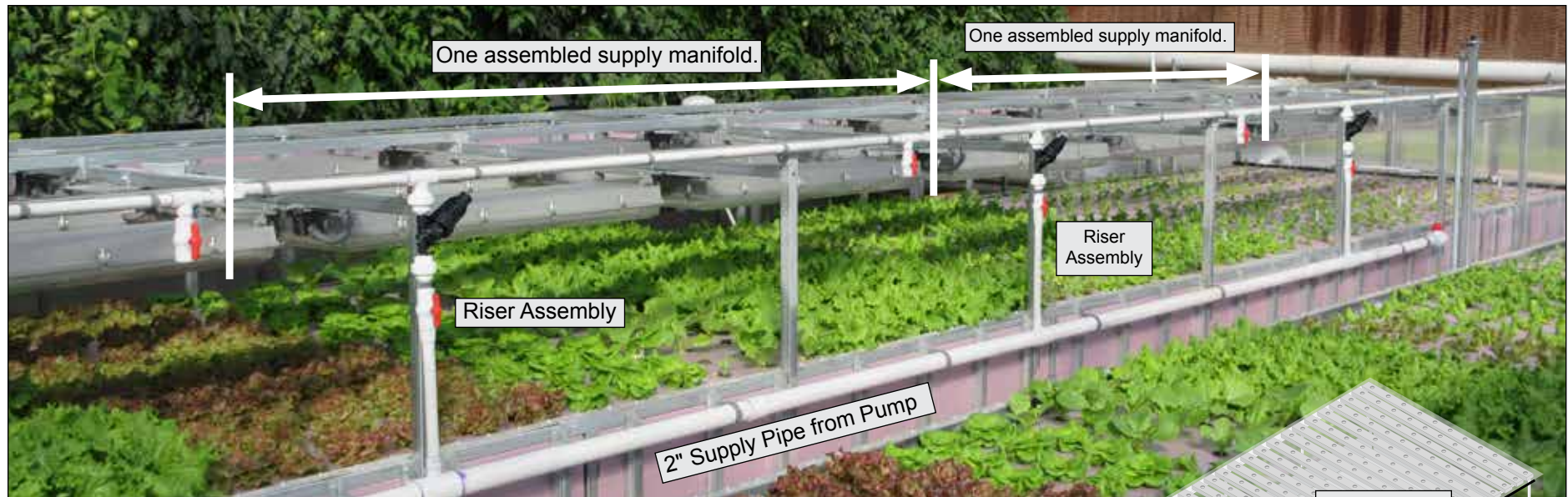


NFT System – Nutrient Supply Manifolds

ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

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10. Repeat steps to construct and secure another supply manifold for the next 17 NFT channels.

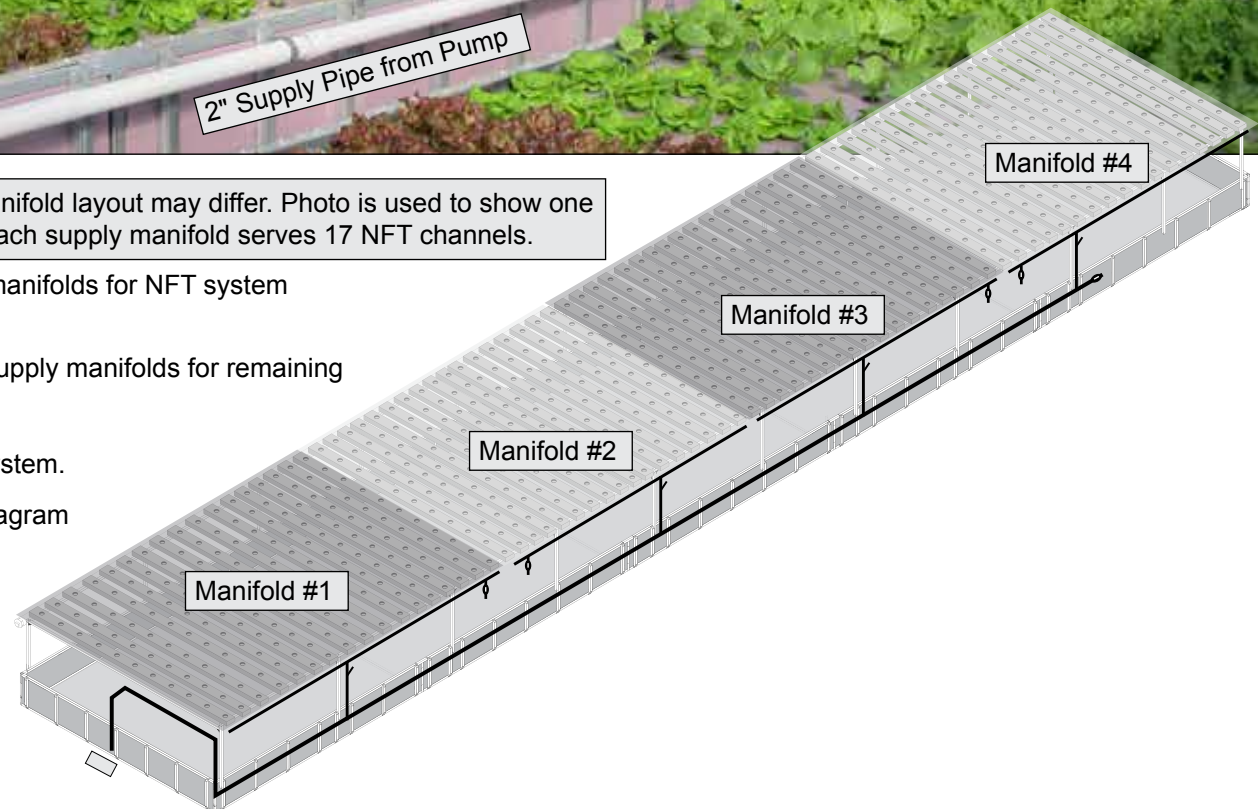


ATTENTION: Actual NFT system and supply manifold layout may differ. Photo is used to show one way to assemble and install supply manifolds. Each supply manifold serves 17 NFT channels.

11. Repeat steps to construct remaining supply manifolds for NFT system above the first raft bed.
12. Repeat all steps to construct and install the supply manifolds for remaining NFT system.

ATTENTION: Layout will mirror that of first system.

13. After installing all supply manifolds, review diagram and photos on next page and install all 1/4" nutrient tubes as described in the next procedure.



ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

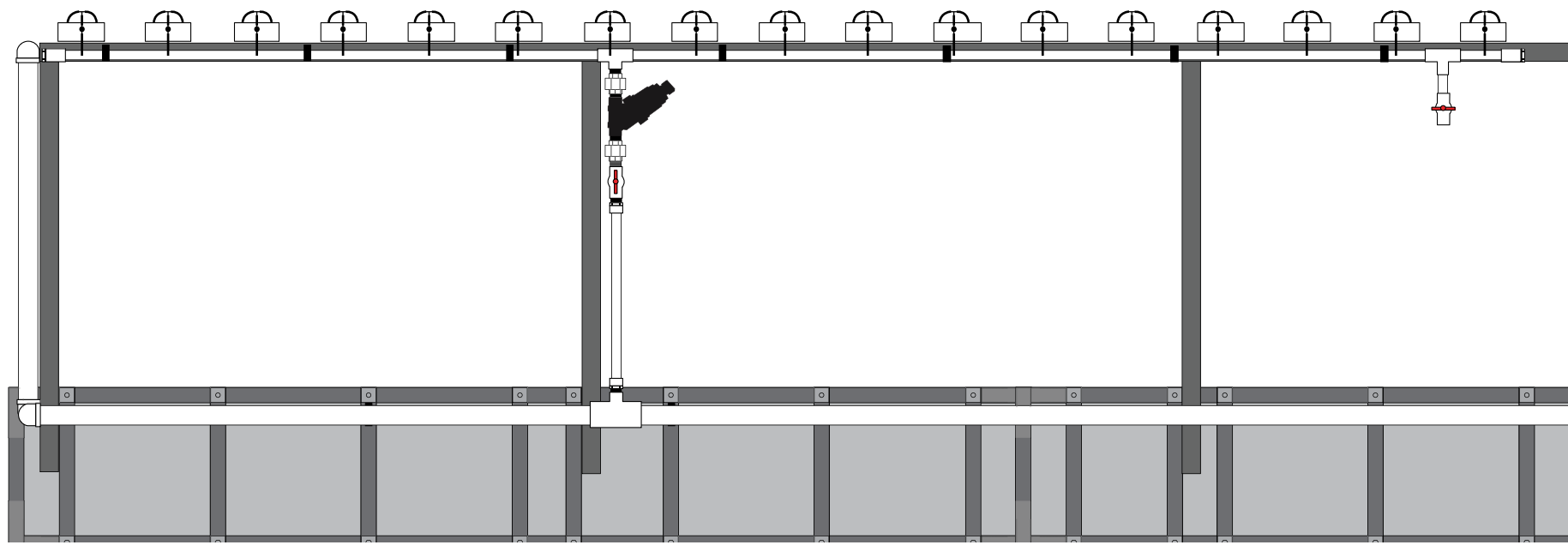
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Final check before assembling and installing the 1/4" nutrient tube assemblies.

- Ensure that no part of any 3/4" supply manifold extends above the top of NFT frame tube. This include the 3/4" pipe hangers.
- Verify all pipe hangers are installed and that supply manifolds are securely snapped in each hanger.
- Inspect all channels to ensure each rests on top of frame tube at the supply manifold end and that all drain elbows are inserted in the 4" drain tube.

Photo at right shows NFT channels with installed 1/4" nutrient tube assemblies. Diagram below shows one bank of 17 NFT channels and one supply manifold to serve these channels.

NOTE: NFT channels are shown setting on NFT frame tube.



ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

COLOR CODE: GRAY

The 1/4" nutrient tubes connect supply manifolds to NFT channels. Each tube assembly includes a 1/4" barb tee, 1/4" micro valve, and sections of 1/4" tubing. (See parts below.) Tube assembly is connected to an adapter fitting installed in the supply manifold at each NFT channel position. Free ends are then inserted through holes drilled in NFT channel cover. Complete the next steps to install adapters and construct tube assemblies.

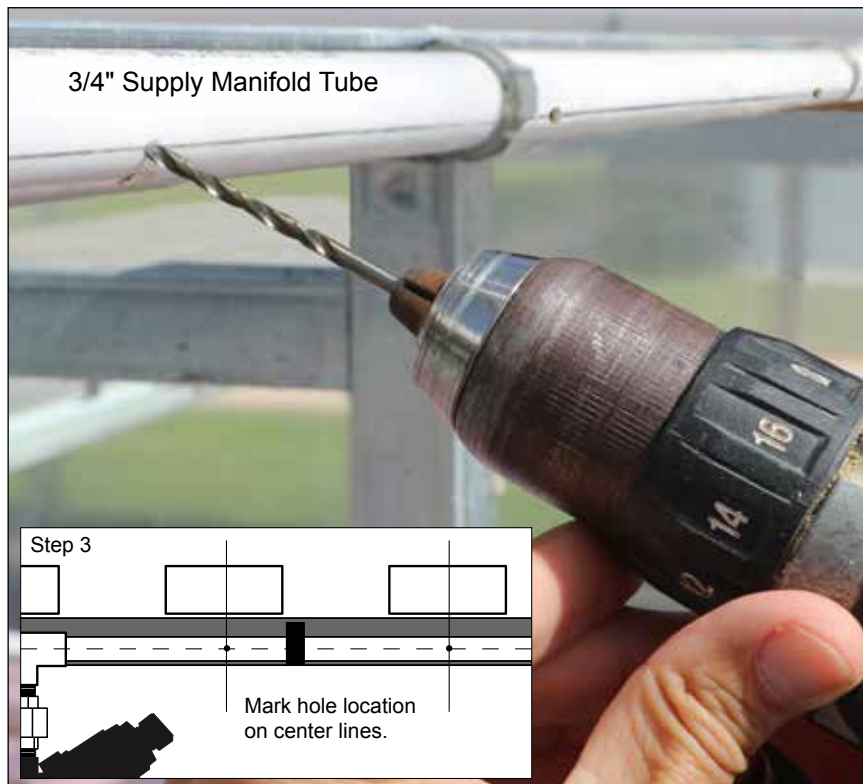
NOTE: There are different ways to complete this procedure. Read through the steps to better understand this procedure and adapt steps as needed to best complete and install these tube assemblies. **A variable speed drill is required for this procedure. Battery-powered works best.**

Complete these steps:

1. Ensure all NFT trays are in place and evenly spaced with drain elbows inserted in 4" drain tube.
2. Snap a chalk line (or draw a line using a non-permanent marker and straight edge) on 3/4" supply manifold tube to keep all adapters aligned.

ATTENTION: Adapters are angled downward slightly when properly installed. See photos (right) for location of line and adapters.

3. Move to the first bank of 17 NFT channels and mark center of each channel on alignment line (Step 2).
4. Take drill bit from the 110829 Drill & Tap Combo Pak, attach it to a drill, and drill a hole in the supply manifold at each NFT channel position marked on manifold.



Required parts and tools listed below.



110829 Drill & Tap
Combo Pak (included)

- Variable-speed, reversible drill
- Non-permanent marker and straight edge, or chalk line



ATTENTION: A variable speed, reversible drill is required. Use a battery-powered drill for best results.

Drill through one wall of the 3/4" PVC tube only! Keep drill steady and angled slightly during drilling. If drill is unsteady, hole will become oversized and may cause adapter to leak once it is installed.

ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

- Remove drill bit and attach thread tap to drill. Test drill to ensure tap is centered in drill chuck. Tap should not wobble when spinning. Loosen and reattach if needed. Carefully and slowly cut threads in first hole.



COLOR CODE: GRAY

Required parts and tools listed below.



WF4790 (1)
Key Punch



109242

ATTENTION: Do not run tap completely into hole. *Do not allow tap to touch inside wall of PVC tube!* To prevent stripping threads from hole, wrap a piece of tape around tap. Measure 5/8" from tip of tap and add tape at that mark to indicate maximum depth of 5/8". **Do not push tap into hole! Allow it to cut threads on its own.**

- After reaching proper depth indicated by the tape, reverse drill and slowly and evenly back tap from the hole.
- Repeat the steps to tap threads in all remaining holes.
- Finally, take a 109242 adapter and thread it into a hole. Using the WF4790 key punch tool, tighten adapter until snug.

ATTENTION: *Do not overtighten! Adapters will snap off. Once slight resistance is felt during installation, stop tightening the adapter!*

- Repeat to install all adapters in supply manifold.
- Repeat this procedure to drill adapter holes in supply manifold and install adapters.
- Continue with the next procedure.

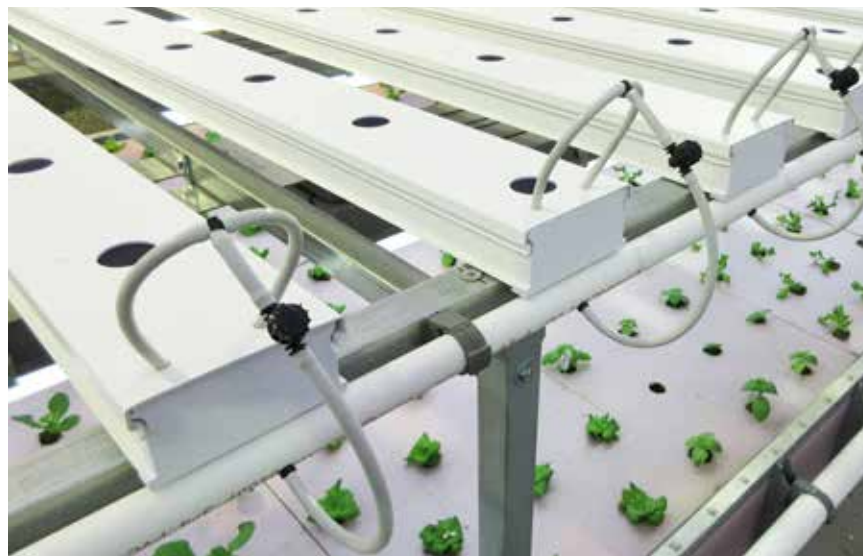


Photo (left) shows 1/4" nutrient tubes assembled and installed on an NFT system above a raft bed.

ASSEMBLE NUTRIENT SUPPLY PLUMBING — continued

Complete these steps to construct and install one 1/4" nutrient tube:

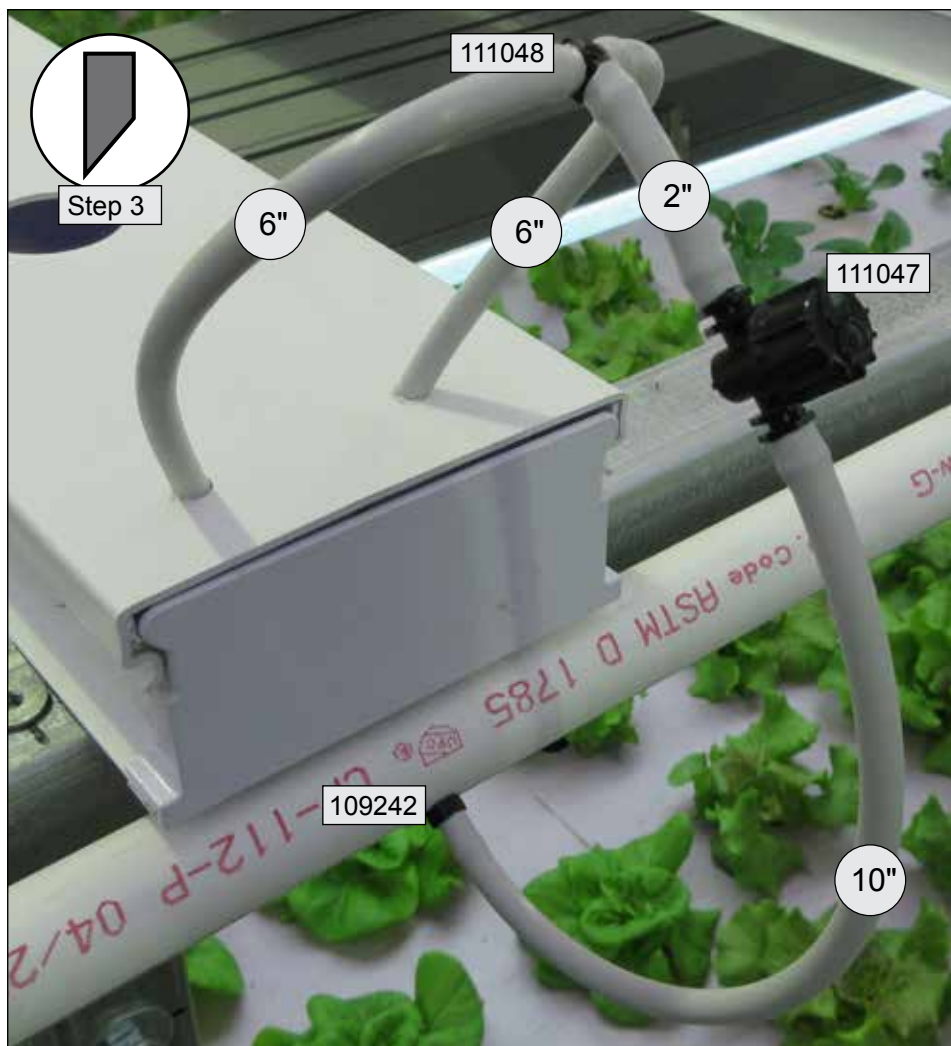
1. Cut one 24" section of 1/4" tubing (111046A) from roll and divide into four (4) pieces at the lengths shown in photo: one (1) at 2"; two (2) at 6" each; one (1) at 10".

2. Connect the individual tubes to the 111048 barb tee fitting and to the 111047 micro valve as shown to create one nutrient tube assembly. *Wet ends of fittings and tubes for easier assembly.*

3. Install tube assembly as shown to check overall fit. Ensure tube end shows a straight, clean cut before sliding onto adapter in supply manifold.

ATTENTION: Trim free end of each 6" tube at an angle to more easily insert it through NFT channel lid if desired. See inset upper-left corner of photo.

4. Shorten tubes if needed to customize fit *before* cutting all tubes to create similar assemblies for all remaining NFT channels.
5. If lengths are confirmed, assemble the remaining 1/4" tube assemblies for all NFT channels.
6. Continue with the next procedure.



NOTE: The above photo shows a 1/4" nutrient tube assembly as installed on a working commercial aquaponic system with NFT channels above raft bed.

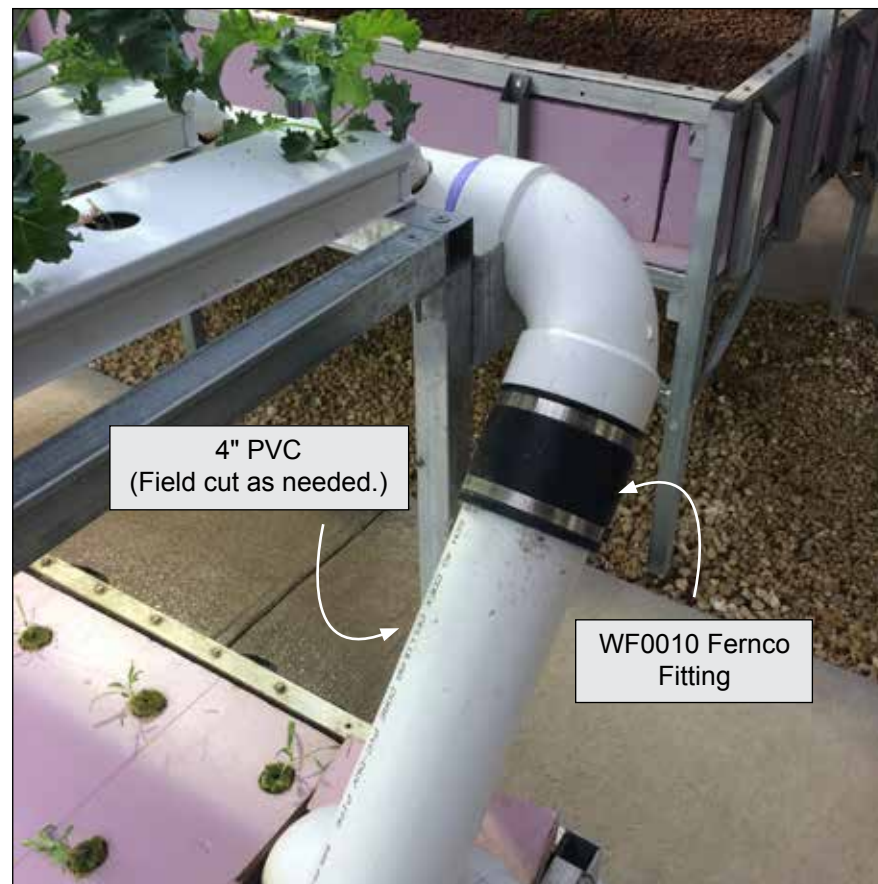
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NFT SYSTEM—Install 4" Drain Outlet to Raft Bed

Use photos on this page and parts shown to construct and install the final drain tube for NFT system.

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Actual system plumbing may differ slightly from what is shown in these photos. Position of aquaponic system plumbing may affect position of NFT drain tube.

ATTENTION: In some instances, additional purchase of 4" PVC fittings may be necessary. For best results, review all plumbing diagrams to best anticipate where final assemblies need to be installed.



System Start-Up

SYSTEM START-UP

Aquaponics systems are functioning ecosystems that require delicacy and patience to setup and maintain. Follow these guidelines to get started:

- **Water Quality:** Water for the system must come from a trusted and controlled source. *Using surface water from a creek or lake is not recommended.* If water is chlorinated, it is important to dechlorinate before adding to the system. **Lab test all water to ensure it is safe for fish, plants, and people.**
- **Adding Water to Raft Beds:** Once system is completely constructed and all electrical service is connected, add water to raft beds.
- **Adding Water to Tanks:** Once system is completely constructed and all electrical service is connected, fill tanks with water. Verify that all drain valves are closed. As each tank fills, monitor its position on stand to ensure tank does not shift. Fill 1,200 gallon tanks 3/4 full then check and set flow rates as described on the next page. Once flow rates are set, fully fill tanks and raft beds.
- **Cycling:** Before populating system with fish (and plants), system must be cycled. Cycling refers to facilitating growth of beneficial autotrophic bacteria that will remove ammonia produced by fish. **Full colonization of systems with bacterial can take 4-6 weeks.** While system is cycling (no plants), keep raft beds covered to prevent algae growth. One option is to place the polystyrene rafts—before drilling plant sites—on the water in each raft bed. Another option is to cover raft beds with an opaque tarp.
- **Adding Fish:** We recommend first adding fish to the system and allow them to get acclimated. If plants are added too early, slower growth and symptoms of nutrient deficiency are likely results.
- **Adding Plants:** Once fish are acclimated, test water to ensure sufficient nutrients are present to facilitate plant growth. After testing, add plants.
- **NFT System (above each raft bed):** After system is up and running and fish and plants are added, the NFT systems can be brought online. Before adding plants to the channels, slightly open the ball valve at each raft bed pump station to allow water to circulate through the NFT channels. Ensure that all thumb valves are open at each channel and that all riser ball valves are open. Check for leaks and for proper drainage from the NFT channels and back to the NFT reservoir. Examine all 1/4" tubes to verify water flows from each. The NFT system is designed for full or partial use by opening or closing the desired riser ball valve or valves. Riser ball valves are also used to adjust flow to the bank of NFT channels served. If flow decreases in one or more banks of NFT channels after prolonged use, close the ball valve of that bank of channels and clean the Y-filter. Reassemble filter, open valve, and check for proper flow. Filters require periodic cleaning. Frequency depends on water quality and overall health of the system. **Check the nutrient level in the water before adding plants to the NFT system to ensure there are sufficient nutrients to support additional plants.**

Adjust Flow Rates

Grow-Out System

Congratulations! Your aquaponic system is now constructed and tanks and raft beds are filled with water. Now it is time to dial in your system to make sure it functions properly. To do this, adjust water flow to each tank using ball valve on each inlet to the 1,200 gallon fish tanks.

System	Number of 1,200 Gallon Grow-Out Tanks	Grow-Out Tank Flow (gallons per minute – gpm)	Total Flow
VI	4	20	80

Start with the grow-out portion of the system. The chart (upper-right) shows the flow for each tank and total flow for the system. Use this information to measure and set the correct flow. **Close ball valve to the NFT system above each raft bed before setting flow rates. See photo on next page. Flow rates may need readjusted once the NFT systems are brought online and populated with plants.**

To measure the flow of water into one (1) fish tank, you need to time how long it takes to fill a known volume with water. An easy way to do this is mark the exact five (5) gallon level on a typical 5-gallon bucket. This is done by pouring a known volume of water into the bucket and marking the level on the bucket. Water can also be weighed. Five (5) gallons of water weighs 41.7 pounds at room temperature.

Once you know the exact level of five (5) gallons in the bucket, take a stopwatch and time how long it takes the tank inlet pipe to fill the bucket up to that level. Use the formula below to determine how long it should take to fill a “known volume” of water.

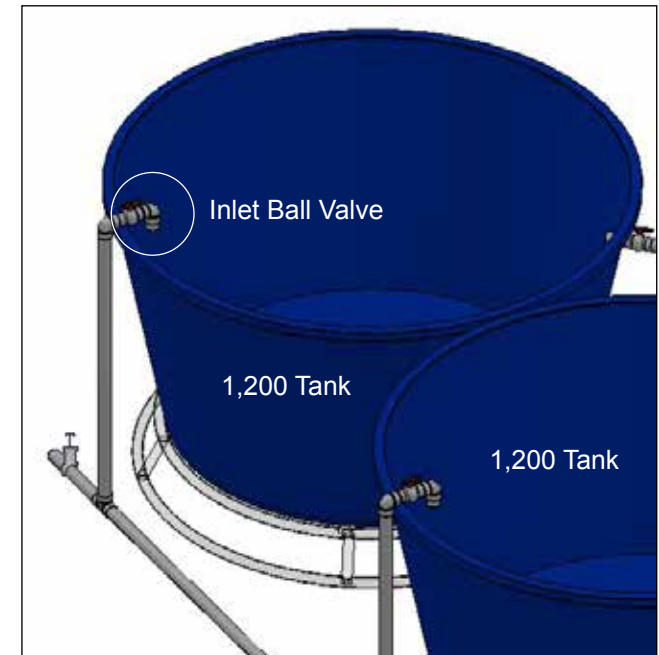
$$\frac{\text{Known Volume (gallons)}}{\text{Desired Flow Rate (gpm)}} \times 60 = \text{Time (seconds)}$$

If the desired flow into a tank is 20 gallons per minute, it will take exactly 15 seconds to fill your bucket to the line.

$$\frac{5 \text{ gallons}}{20 \text{ gpm}} \times 60 = 15 \text{ seconds}$$

If the bucket fills faster, restrict the flow to the tank by slightly closing the inlet ball valve. If it takes longer than 15 seconds, slightly open the valve to increase the flow. After you have dialed this in for the first tank, move to the next tank and repeat the process. After setting flow rate for all tanks, recheck each tank to ensure rate remains at 20 gallons per minute. Adjust flow as needed. Repeat as needed to confirm all tanks flow evenly.

NOTE: Recheck flow rates after pumps run for at least 15 minutes to ensure all air is out of the lines and pump is at a steady-state flow. If fish tank is filled, simply place bucket under inlet fitting. As bucket fills with water, it will begin to sink in the tank. Do not let tank water flow into your bucket as it will skew results.



Grow-Out System—Monitor Raft Bed Levels

After setting flow rates for each tank, monitor raft levels in raft beds to determine if these fluctuate. Depending on the setup, water from the sump tank may not flow evenly to the raft beds. One typical cause is differential friction in the piping. To remedy this, slightly adjust the gate valves between the sump tank and raft beds. If rafts in one bed are consistently higher than the other, restrict the flow to that bed by moderately closing the gate valve to the higher bed. Check the levels an hour or two later to see if beds have levelled out. If they have not, repeat the steps to adjust the valve until raft beds are level with each other.



ATTENTION: Close valve to NFT system to set flow rate to fish tanks. Once NFT system is functioning, recheck flow rates and adjust as needed.

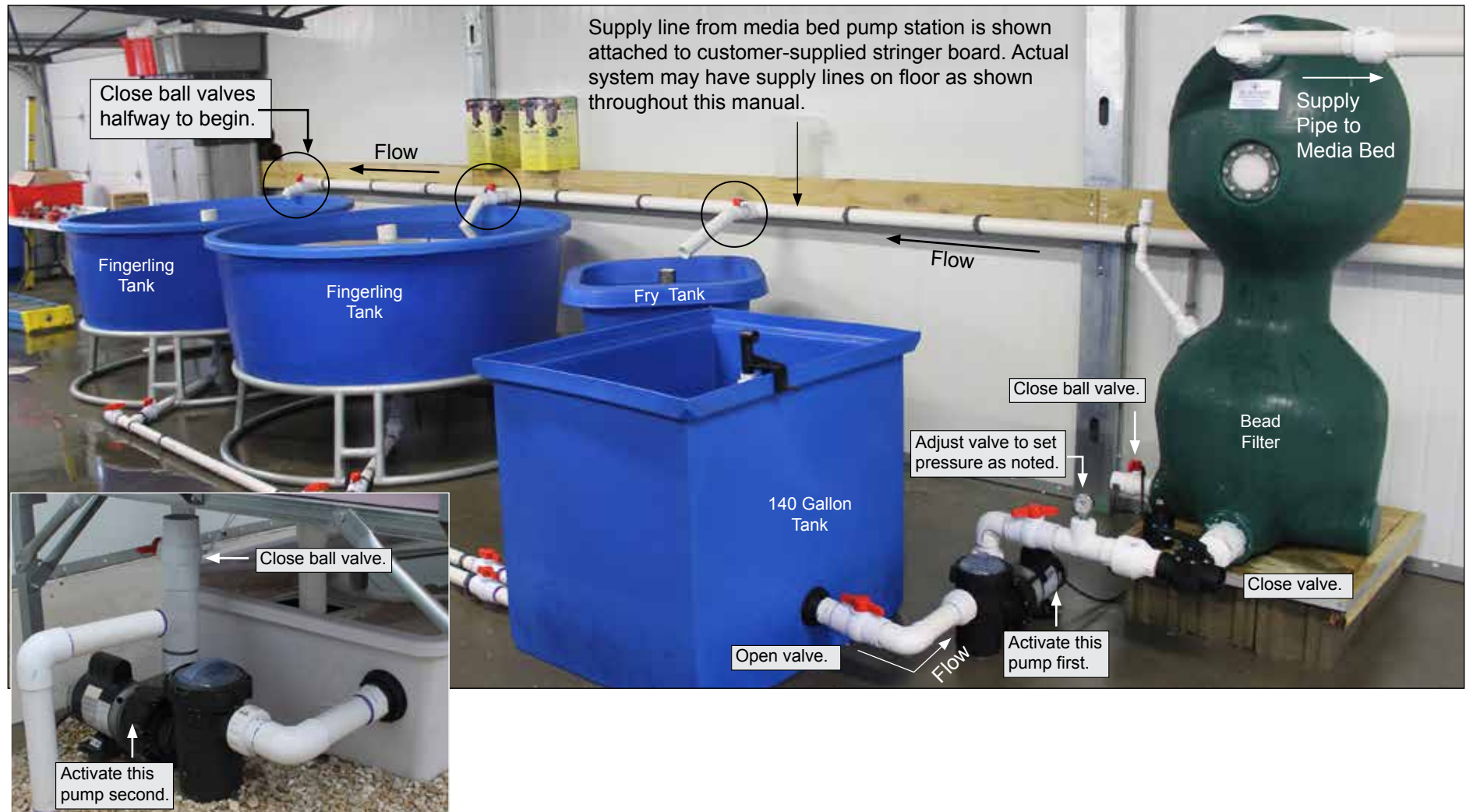
Adjust Flow Rates

Fingerling System

With the grow-out system dialed in and running, it is time to set flow rates for the fingerling system. Like the grow-out system, flow rates to each tank must be measured and adjusted. See next page for recommended flows to each tank.

To begin, activate the pump positioned before bead filter. (See photo below.) Adjust ball valve before the bead filter so that pressure does not exceed 10 psi. Each bead filter is a bit different; running pressure at 4-8 psi is recommended.

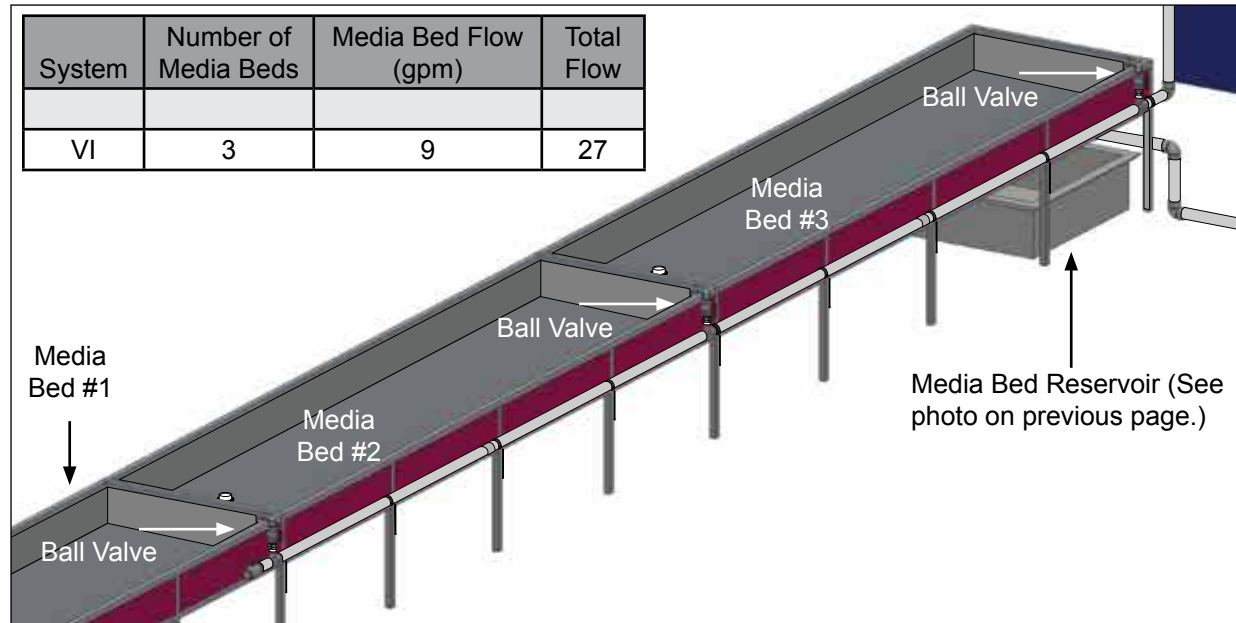
Next, close the ball valves to all fingerling fish tanks *about halfway* to prevent too much overflow during this process. Finally, turn on the pump at the media bed reservoir. (See photo inset—lower left.) Ensure reservoir is filled with water. Some tanks will lose water while setting flow rates. This is normal. **Ensure all electrical cords are off the floor and away from water tanks if present.**



Adjust Flow Rates

Fingerling System — continued

Once both pumps are running, measure and adjust flow rate to each media bed. (System VI has three (3) media beds.) Review grow-out system procedure if needed. For this system, nine (9) gallons per minute per media bed section is sufficient. For nine (9) gallons per minute, it should take 33.3 seconds to fill the 5-gallon bucket. If you choose to use a smaller known volume (1 gallon pitcher) it should take 6.67 seconds to fill the 1-gallon container, as calculated using the formula presented in the grow-out system section.



Adjust ball valve as needed for each media bed to set the proper flow rate. See arrows in diagram to the left. Check flow rate at each inlet fitting.

After adjusting ball valve for each media bed, move to the fish tanks. Use the chart below and diagrams on the previous page to determine flow rate to the fry and fingerling tanks. Adjust each ball valve to set the proper flow rate.

System	Number of Fry Tanks	Fry Tank Flow (gallons per minute—gpm)	Number of Fingerling Tanks	Fingerling Tank Flow (gpm)	Total Flow
VI	1	3	2	12	27

IMPORTANT: The sum of all fish tank flows (fry and fingerling) is equal to the sum of all media bed flows when rates are properly set. ***It is important that flow rates into and out of each system (fingerling and media beds) are equal.*** Significant water loss may occur if flow rates are not matched between the two systems. Minor adjustments are required to fine tune flow rates. *Do not populate tanks until flow rates are set and system has cycled as required.*

Fish Stocking

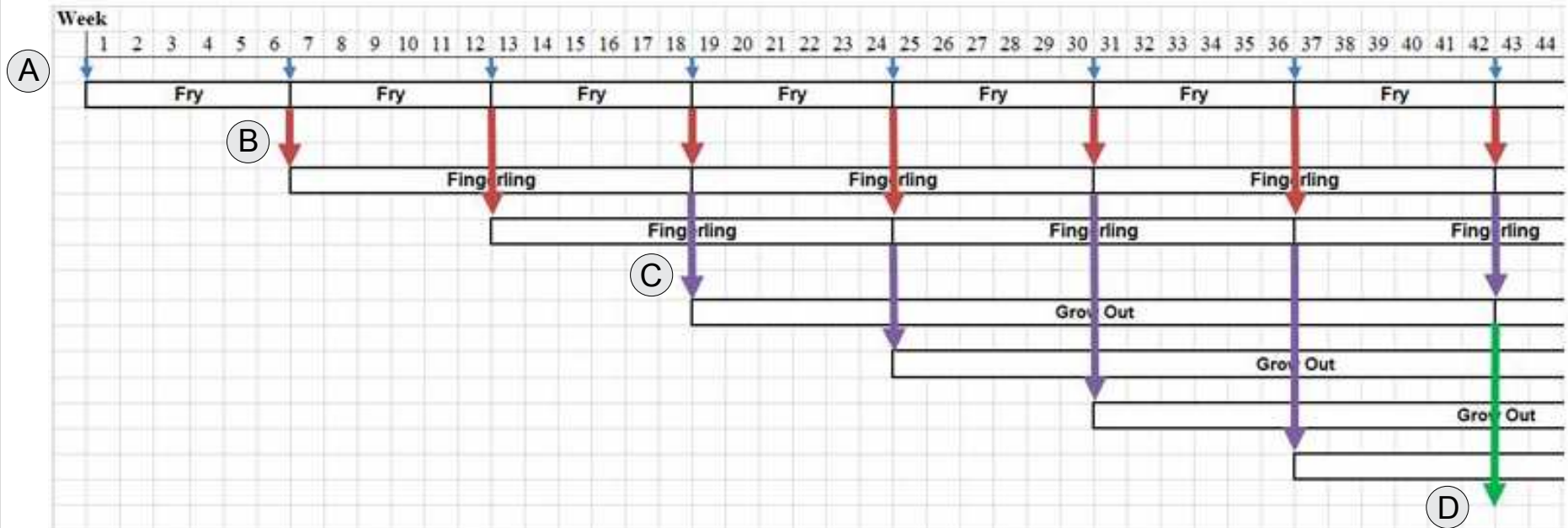
Fish Stocking

Our commercial aquaponic systems were designed specifically around raising tilapia. The following fish stocking and density information is relevant for **tilapia only**; however that does not mean these are the only fish you can raise. For others, such as trout, yellow perch, or koi to name a few, please contact your local aquaculture extension, or call our customer service for more assistance.

Each system was created with a balance of fish and plants in mind. It is important to adhere to these guidelines in order to maintain that balance. The following chart is a recommendation of fish stocking and harvesting numbers. It serves as a guide to determine fish density at any given time in the system.

System	Number of Fish to Stock	Stocking & Harvesting Frequency (weeks)	Number of Fish Harvested	Initial Size (g)	Time to Harvest (weeks)	Weeks in Fry Tank	Weeks in Fingerling Tank	Weeks in Grow-Out Tank
VI	450 - 500	6	400 - 425	0.5 - 1.0	42	6	12	24

This aquaponic system includes a nursery (with fry and fingerling tanks) and a grow-out section (with 1200 gallon tanks) to facilitate a constant rotation of fish in minimal space. The chart below helps determine how long the fish need to stay in each tank and how often they should be rotated to a different tank. The following chart presents a sample bioplan used for System V and System VI as an example.



Line A arrows represent fish introduced into the system. Line B arrows represent the transfer of fish from fry tank to a fingerling tank. Line C arrows represent a transfer of fish from a fingerling tank to a grow-out tank. The D arrow represents harvesting fish.

ATTENTION: When moving fish, it is important to move the entire tank population, or cohort, at the same time, or risk stressing the fish. The fewer times you move fish as they grow, the better.

Customer Notes and Records

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Customer Notes and Records

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